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ABSTRACT

This handbook was assembled for vocational educators so that they can see the applications of microcomputers in both their instructional and administrative tasks. The 22 papers included in the handbook were written by educators who are and have been using microcomputers extensively in their work. The first section of the handbook discusses the general issues that any educator would need to examine. Topics discussed include computer literacy, buying hardware, evaluating software, designing user-friendly software, authoring systems, beginning programming, using the microcomputer to reach special needs students, and functioning in the office of the future. The second section of the book focuses on the following vocational education curricula areas: agriculture, business education, home economics, trade and industrial education, distributive education and marketing, health education, and adult education. In each chapter, the authors discuss the following questions: (1) How can microcomputers be integrated into the curricula? (2) What are effective uses of microcomputers? (3) How can microcomputers improve instruction? (4) What should microcomputers not be used for? (5) How will microcomputers change teacher/student roles in learning? (6) How can microcomputers be integrated into the total curriculum? (7) What software packages are useful? (8) What resources, publications, research papers, and so on are available? In addition, a chapter on emerging occupations is included. Short biographies of the contributors of the papers complete the text. (Author/KC)

ED239052

MICROCOMPUTERS: APPLICATIONS IN VOCATIONAL EDUCATION

Editors:

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Roger Lambert, Ph.D.

U.S. DEPARTMENT OF EDUCATION
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Introduction

Most observers would agree that the technological changes brought about by microcomputers can best be described as "revolutionary." Whether we interact with automatic banking systems, computerized cash registers, or instructional systems in the classrooms, it is evident that eventually all facets of our life will be affected by computers. How do these changes impact on vocational education?

Many journals and texts examine the microcomputer as an instructional tool, or a medium of instruction. Conventions and seminars are also designed to examine the computer's impact on education. Whether browsing through a table of contents or looking over agenda items at a conference, one will discover that little attention is paid to the unique needs of vocational educators.

A vocational educator teaches and instructs using a methodology similar to that of other educators. Therefore, much that has been said about the microcomputer as an instructional tool also holds true for vocational educators. There is a major difference, however, in the way educators, and the sub-group, vocational educators, interact with microcomputers. This difference has not received the necessary attention in the literature or in the classroom. In vocational education, the microcomputer is not merely an instructional aid. The microcomputer is also the object of instruction: a major tool of work.

This handbook was assembled for vocational educators so that they may see the applications of microcomputers both in their instructional and administrative tasks. All the papers included in the handbook were written by educators who are and have been using microcomputers extensively in their work. The first section of the handbook discusses the general issues that any educator will need to examine. Topics discussed include computer literacy, buying hardware, evaluating software, designing user friendly software, authoring systems, beginning programming, using the microcomputer to reach special needs students and the office of the future. The second section of the book focuses on the curricular areas that are particular to vocational education. These curricular areas include: Agriculture, Business Education, Home Economics, Trade and Industrial Education, Distributive Education and Marketing, Health Education, and Audlt Education. In each chapter, the authors discuss the following questions:

- How can microcomputers be integrated into the curricula?
- What are effective uses of microcomputers?
- How can microcomputers improve instruction?
- What should microcomputers not be used for?
- How will microcomputers change the teacher/student roles in learning?
- How do you integrate microcomputers into the total curriculum, instructional units, lesson plans?
- What software packages are useful, and how have they been integrated into the curriculum?
- What resources, publications, research papers, etc., are available?

In addition, a chapter on emerging occupations is included.

Microcomputers are now an integral part of instruction and administration. This handbook serves as an introduction to the different ways they can be and will be used within vocational education.

Judith Rodenstein, Ph.D., Editor

Roger H. Lambert, Ph.D., Editor

COMPUTER LITERACY: IT'S MORE THAN JUST COMPUTER PROGRAMMING

Jacqueline Janik
Computer Resource Center
Milwaukee Area Technical College

> If airlines had progressed as rapidly in development as computers, the Concord would be carrying 500,000 passengers at 20,000,000 mph for less than 1¢ per person to London.
>
> If the progress of manned flight had increased at the rate of computer technology, an astronaut could have orbited the earth nine years after the Kitty Hawk flight. (14, p.220)

Introduction

Computers are electronic devices that accept, process, and store data as discrete symbols. The key word in this machine's name is compute. Its ancestors are pebbles and tally sticks used to keep count of quantities. The 12th century abacus, person managed and performed, is another relative. Today's computer is highly complicated but manageable by most people if they know more about it than just punching a certain sequence of buttons. The need for knowledge about the computer has been likened to that of the telephone or car. Granted some can get along very nicely just knowing what buttons to punch or wheels to turn, but the range of possibilities of use for computers compared to that of the telephone and car seems to render the argument rather questionable.

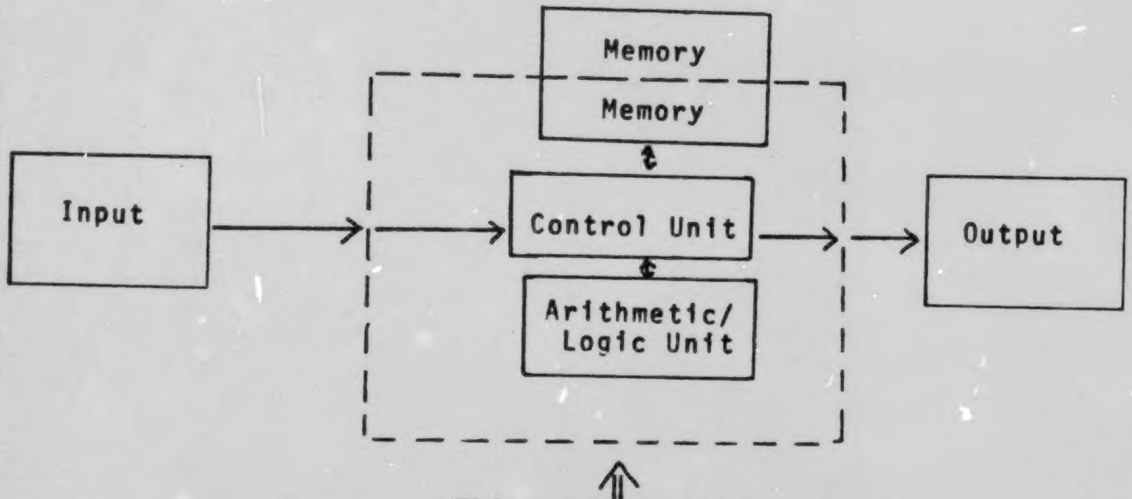
What is Computer Literacy?

There are as many definitions of Computer Literacy as there are books and magazine articles about it. It is generally understood to be that level of understanding a person needs to function effectively in a computerized society. This area of study should deal with what a computer can't do, e.g., express feelings, as well as what it can do, e.g., hold a conversation with you (the ELIZA-type program). Of course the computer isn't really conversing with you. It is just following the instructions previously given it by a human being.

Knowing all one can about computers isn't meaningless in our society as we try to project future contact with them. They are affecting our daily lives everywhere we turn even now. In the January/February 1978 issue of Creative Computing, there is an interesting article, "Five Who Most Disturbed the Thought of Man." The first was Copernicus with his nonearth centered universe, the second Darwin with man as not a special creation. The third was Freud with no rational self-determination, the fourth Einstein with a weakening of man's confidence in his observations of the physical world. Lastly is the computer with man as not unique as an intelligent manipulator of the environment and solver of problems. (1,p.34)

The four main areas discussed in this paper are hardware, programming and algorithms, applications, and social impact.

THE FIVE MAIN PARTS OF THE COMPUTER


Memory
Memory
Input
Control Unit
Output
Arithmetic/
Logic Unit

This whole section
is the Central
Processing Unit (CPU).

Note: Some Memory is part of the Central Processing Unit, and some is external to that part of the Computer.

Hardware

The five main parts of the computer are input, memory, the arithmetic/logic unit with accumulator, the control unit, and output. The middle three are the CPU, the Central Processing Unit. Jargon and buzz words abound here. One needs to know only the general concepts and not all the electrical intricacies so that when "computer people" talk or when one reads an article about computers elsewhere the "lay person" won't feel he has invaded some secret ritual for some mystical cult. They are just talking about pieces of equipment and their characteristics among themselves and to the outside world.

The three main drives for computer evolution are the need for automated arithmetic (Pascal, Leibnitz; 1600's), the need for a programmed device (Babbage; 1800's), and the need for stored instructions (von Neuman, Mauchly, Eckert; mid 1940's). This last drive set the stage for the four generations of computers: vacuum tubes (1946), transistors (1959), integrated circuits (1965), and integrated circuit chips (1970's). Integrated circuit chips made the TRS80, Pet and Apple microcomputers possible in 1977.

Besides the general purpose computer, mention should be made of special purpose computers, e.g., digital wristwatch, electronic car ignition. The peripherals to the computer come next: card reader, keypunch, line printer, terminals, disk drives, modems; with the accompanying I/O (input/output) media: punch cards, magnetic cards, magnetic tape, magnetic disks, and microfilm.

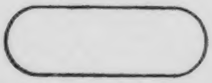
Programming and Algorithms

Programming is the process of writing the instructions in correct order to prepare the computer to perform a certain set of tasks. The language used can be very close to the instructions the machine actually uses, the machine language, or a set of abbreviations with commands and arguments, the assembler language, or a rather human-like language that is problem-orientated, the high level language. There are many high level languages starting with FORTRAN (FORmula TRANslation) in 1957 to BASIC (Beginners All-purpose Symbolic Instruction Code) in 1959, COBOL (COmmon Business Oriented Language) in 1959, Pascal (named after Blaise Pascal), RPG (Report Program Generator), and ALGOL (ALGOrithmic Language). All have the general concepts of

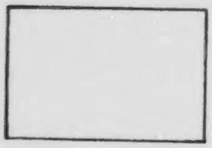
read
print
store
bring from memory storage

add
subtract
multiply
divide
stop.

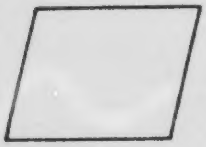
Before anyone starts writing the instructions in code form, one should establish a flow for the instructions usually in a compressed diagram called a flow chart. The five basic symbols are

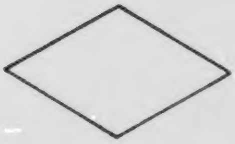


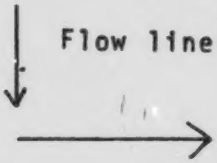
Start,Stop



Process







Certain tasks are used over and over again. The instructions are defined mathematics or logic procedures to solve a problem in a finite number of steps. These instructions become algorithms unambiguous, precisely defined, and effective.

Depending how close to machine language is the language one chooses to use will affect how fast the computer can start executing or performing the task assigned. Depending on the task to be done, certain languages lend themselves to one or other type of task by their very name.

Applications

Everywhere one looks today there seems to be a new use for a computer. If not, then someone is working on one. In the health care area, besides the administrative uses for billing, insurance, room assignment, and diets or prescriptions, medical histories, on-line monitoring, and increased diagnosis, e.g., blood tests, are taken and performed and recorded. Medical schools are running more simulations for their students, programs which can lead to the death of the case history "patient". Recertification of current physicians is starting to be performed with the use of microcomputers.

There are the standard business and financial applications of payroll, accounting, billing, word processing, and banking; but they are no longer restricted to large companies that can buy a computer of their own or can buy large amounts of computer time and memory space from service bureaus. When the Electronic Funds Transfer System (EFTS) becomes a reality, there will be no more floating of checks; for each transaction will be complete and immediate. But equipment failure here could mean a "credit blackout". No computer means no transactions!! Stores are maintaining inventory control with point of sale marketing using the Universal Product Code. Banking has an equivalent coding system, the Magnetic Ink Character Recognition (MICR). Next time the pack of cancelled checks arrives home, look at the bottom of one of them. The left side contains the checking account number and the bank number. The middle contains the individual check number. The right side now contains the amount of this check. Look at an unused check and compare them. There is no printing on the right side of the bottom of the unused check. Someone in the bank used a machine to imprint those characters onto those checks.

Science has its mathematical analysis, statistical analysis, simulation, and real time experiments. A specialized area of science, space science, has tracking space vehicles, mission control, navigation, missle guidance, monitoring of astronauts as well as its own simulations. In April 1970 a computer aided in guiding a crippled Apollo 13 spacecraft back to Earth from the moon. This April the Challenger spacecraft designed with a computer was guided and monitored by another one.

The Federal Bureau of Investigation (FBI) established the National Crime Information Center (NCIC) in the 1960's to coordinate information pertinent to its line of work. The legal profession has legal information retrieval systems, and the courts maintain records and select juries by computer.

In this age of computer graphics, computer usage in industry has especially come to the fore. There is also the analysis of writing style, detecting the influence of one poet on the works of another, choreographing a ballet, and composing a symphony.

There are the applications of the quite visible home computers. Some computers are not so obvious; they are the embedded computers. Microwave ovens, blenders, automobiles, televisions, stereo turntables, cameras, and telephones can be guided and controlled by computers. Computers will help handicapped people move, talk, and even live.

Social Impact

Society today and tomorrow will have need of the computer's information. A microbe on earth 3 billion years ago contained 1 million bits of information in it, roughly 1 book say. The human being today in his genes contains 3,000 books of information and 3,000,000 books of information in his brain. Somewhere else all this additional information must be stored and be ready for use when necessary. For all its trouble, computerized information is harder to be copied, altered, or destroyed by the routine user: the secretary misfiling a folder, the custodian incinerating valuable papers. Malicious actions (theft, fraud, forgery, trespassing, or wrongful interference) can be minimized by "keys" or identification cards, passwords, or voice/finger/handprinting. Another danger is misuse of data or false data on which one cannot check. The Privacy Act of 1974 allows any American citizen the right to investigate the federal files on himself to verify the information, include a letter noting discrepancies to be included in that file. Only catch is that one must apply to each data base individually in writing, roughly 1800 groups of data files maintained by 82 federal agencies.

Artificial Intelligence (AI) is the branch of computer science that studies how to make computers smarter. Natural-language understanding, speech and pattern recognition, image analysis, and information retrieval are areas of application of AI. Can this mean a take over by the computer? Could there be a real HAL as in 2001: A Space Odyssey or a real PROTEUS from Demon Seed or even COLLOSSUS in the story of the same name by D.F. Jones? One might say that's science fiction. Remember that the science fiction of 20 or 30 years ago are the computer applications of today.

This priesthood of "computer people" has established a need for a new classification for people: technocrats and computer peasants. There are extremists also. The people that practically eat, breathe, and sleep computers could be considered cyberphils. The other extreme group of people are those who don't want to even admit the existence of computers let alond touch them are the cyberphobs, suffering from technology shock. They feel dehumanized where the person appears to be the slave to the technology and may even feel aggressive to the computer.

For the jobs lost by the introduction of the computer into a company, the employee can be retrained and could let the computer help match job opportunities to his abilities. New jobs are being established. People are needed to design, build and maintain this equipment. People are needed to write the required programs and to input the necessary data. A whole field of human factors engineering or ergonomics has blossomed trying to make the computers, the lights, furniture, and terminal keyboards "user-friendly".

Affective Domain

In the last 9 pages, the major emphasis was on the six areas of the Cognitive Domain of Benjamin Bloom: knowledge, comprehension, application, analysis, synthesis, and evaluation. These constitute what can be considered a regular approach to a body of knowledge.

The uses and roles of the computer in people's lives are so highly charged with emotion that a concerted effort must be made in the five major areas of the Affective Domain: receiving, responding, valuing, organization, and characterization by a value system.

These areas must be taken into account and worked on by even instructors of business data processing and computer science. Students should learn to help other people cope with computers since these students are to be considered in the group "computer people". Ethical standards should be nurtured. Only with viligance will the abuses of computer power ever be stopped before starting. Tolerance of non "computer people" is to be encouraged. Legal responsibilities of computer use should be explained and discussed with the student establishing a judgment system to govern his conduct in using the computer.

MECC Report

The State of Minnedota has established a public organization called the Minnesota Educational Computing Consortium (MECC) in 1973 to assist Minnesota colleges and schools implementing educational computing. MECC has provided low-cost time-sharing computer systems and microcomputer purchase contracts at group rates, development of educational courseware, and inservice training of educators.

In 1979, the Minnesota Computer Literacy and Awareness Assessment instrument was designed for the assessment of secondary school students. In the Cognitive Domain, questions were developed to test the Computer Literacy areas of hardware, programming and algorithms, software and data processing, applications, and impact. Questions testing attitudes, values, and motivation constituted the Affective Domain.

The MECC study questions are interesting to answer to find one's own approach to computers. A set of similar questions at the beginning of a Computer Literacy course and repeated at the end with a comparison between the two sets of responses would be enlightening. Some sample questions are:

8. Walking through a room filled with computers would make me feel uneasy.
15. Computers are gaining too much control over my life.
19. Computers can be useful in learning many subjects besides mathematics.
32. Most nurses give injections by computer.
42. Some computers know just about everything.

(2, Appendix F)

This study isn't meant to be the answer though. There are objectors, Arthur Luehrmann for example, who state that Computer Literacy is the ability to do computing so that there is just a need for performance objectives. The report gives the state of computer education in Minnesota during 1978-1979. It deals with Computer Literacy with respect to informational objectives, above broad learning goals but short of specific behavioral objectives.

Computer Literacy is not Computer Science. Hands-on experience doesn't necessarily lead to Computer Literate people.

Other projects primarily Computer Assisted Instruction involved the development of new equipment. One predates the establishment of MECC. In 1960 Donald Bitzer at the University of Illinois designed a new system called PLATO (Programmed Logic for Automated Teaching Operations). It didn't start out as a Computer Literacy project. Yet today a version of PLATO scaled down to fit an Apple II Plus microcomputer is teaching Computer Literacy. Kenneth Stetten at MITRE Corporation together with Brigham Young University developed TICCIT (Time-shared Interactive Computer Controlled Informational Television). Educators involved with Computer Literacy can and should use these and whatever new equipment that comes into being to reach the most people.

Position Statements

Following are two position statements the first from the Board of Directors of the National Council of Teachers of Mathematics in September 1976 and the second from the National Council of Supervisors of Mathematics in 1978. They seem to summarize nicely the current situation.

> Although computers have become an essential tool of our society, their diverse and sustained effects on all of us are frequently overlooked. The astounding computational power of the computer has altered priorities in the mathematics curriculum with respect to both content and instructional practices. Improvements in computer technology continue to make computers, minicomputers, and programmable calculators increasingly accessible to greater numbers of students at reasonable cost.
>
> An essential outcome of contemporary education is computer literacy. Every student should have firsthand experiences with both the capabilities and the limitations of computers through contemporary applications. Although the study of computers is intrinsically valuable, educators

> should also develop an awareness of the advantages of computers both in interdisciplinary problem solving and as an instructional aid. Educational decision makers, including classroom teachers, should seek to make computers readily available as an integral part of the educational program.
>
> (12, p.468)

> It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society, such as their use in teaching/learning, financial transactions, and information storage and retrieval. The "mystique" surrounding computers is disturbing and can put persons with no understanding of computers at a disadvantage.
>
> (11, p.150)

These two statements summarize educators' recognition of the need for Computer Literacy even though they are both from Mathematics educators. With the proliferation of microcomputers it is now possible for small school systems and individuals to buy a starter microcomputer for less than $100. Computer Literacy is just a start into the future.

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COMPUTER LITERACY*

by Daniel L. Klassen and Ronald E. Anderson

Introduction

During the past decade, computer technology has come to play a very important, often pivotal, role in American scientific, business, industrial, and governmental institutions. Efforts to improve productivity, increase efficiency and service, and to cope with the "information explosion" have spawned thousands of uses for computers. Our nation, it has been observed, has been transformed from an industrial society into an information society that relies heavily on computers and related information systems (11). According to a recent government report, the largest single class of employees in the United States today have jobs dealing, in the broadest sense, with information processing and communications, and it is well known that computer technology has influenced these areas extensively (45). In addition to the many known uses of computers, it is estimated that there are thousands of applications of the computer still awaiting discovery. As a recent TIME article put it, "Amazing feats of memory and execution become possible in everything from automobile engines to universities and hospitals, from farms to banks and corporate offices, from outer space to a baby's nursery" (15). To ask what these applications are is like asking what are the applications of electricity. There is little doubt, it seems, that life in the United States and in the rest of the industrial world, and eventually all over the planet, will be incalculably changed by computer technology.

Need For Computer Literacy

In an information society such as ours, widespread understanding of computer technology and the consequences of computer use and misuse is necessary, even required, for public policymaking. A lack of understanding and acceptance of computers could seriously impede the use of computer technology

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in solving important problems. Many observers of the role of computer technology in society believe that if the gap between current technological capacity and the ordinary person's understanding of the technology is allowed to grow too wide, the social and political, as well as scientific, ramifications are likely to be very serious (36). Special concern about computers and information systems is justified because of their unique features and their close association with large bureaucratic institutions and the enterprise of science.

For the individual, an understanding of computer technology and uses is important because it reduces bewilderment about computers and promotes a balanced view of the computer's role in society. Such understanding also enables people to use and influence the design of computer-based social services and to develop informed opinions regarding particular computer applications having political, economic, and social implications.

Public understanding of computers and their applications has not kept pace with their availability and use. The AFIPS/TIME survey in 1971 showed that public attitudes are often unrealistic and negative, and understanding of computers is sometimes incorrect. The young, who have grown up in the "computer age" are not much better informed. The recently conducted Minnesota computer literacy study found that most junior and senior high school students know very little about computers and their implications for society (27). Furthermore, most students do not understand the general limitations of computers. For instance, over half of the 1,500 students tested believe that "computers help people make decisions by providing correct answers to any question." Whereas those with no prior exposure to computers were more likely to give the incorrect response to this item, 43 percent of the students with computer programming experience also answered incorrectly. Answers to many other questions showed a similar lack of understanding and awareness. It is clear from this and other research (7) that students lack realistic views and basic knowledge of computers and that mere exposure to computers does not automatically eradicate misconceptions.

The growing recognition of the importance of widespread public understanding of computers in an information/computer society has prompted concerned educators to urge the launching of educational efforts to eliminate, or at least reduce, computer illiteracy. The President's Science Advisory Committee and the Organization for Economic Cooperation and Development, in the late 1960's, were among the first groups to recognize the need to educate citizens. At about the same time, many educational and scientific societies also recognized this need. The International Federation of Information Processing Societies' Working Group in Secondary School Education, for instance, suggested that since it is important for all students to understand the nature and use of computers in modern society, teachers of all subjects should have a knowledge of computing. The Association of Computing Machinery's Elementary and Secondary Schools Subcommittee's Working Group on Computing Competencies for Teachers recently issued a similar plea (50). On several occasions, the Conference Board of Mathematical Sciences has also recommended the development of a computer literacy curriculum for precollege students (17); and in 1978, the National Council of Supervisors of Mathematics issued a position paper which included computer literacy for all citizens in a list of 10 basic skills. Most recently, the National Council for the Social Studies, in its position statement on curriculum, suggests that students be taught data processing skills.

In what is perhaps the most complete analysis of the importance of computer literacy, Andrew Molnar concludes that there is

> ...a national need to foster computer literacy. Further, if we are to meet this need, we must ensure that high school graduates have an understanding of the uses and applications of the computer in society and its effect upon their everyday lives....A nation concerned with its social needs and economic growth cannot be indifferent to the problems of literacy. If we are to reap the benefits of science-driven industries, we must develop a computer-literate society.(37)

Definitions of Computer Literacy

Ten years ago "computer literacy" was a novel phrase, but now it is commonly used by educators, computer scientists, and journalists. Computer literacy has two major definitional roots: (1) the variety of specialized literacies, such as scientific literacy; and (2) general language literacy which encompasses reading, writing, and understanding. The conjunction of "computer" and "literacy" has had an intuitive appeal since communication with computers via computer language is analogous to interpersonal communication via ordinary language.

There are two generally accepted dictionary definitions of language literacy. One is the ability to communicate (for example, reading and writing); the other is the state of being informed, "cultured," and well versed. Although these definitions may be partially contradictory, the public continues to use the word literacy in these two ways. The descriptor "literate" is generally used to suggest a threshold on the literacy continuum. For instance, we might speak of a literate society as one where almost everyone can read and write. Or we might refer to a learned, knowledgeable, well-read person as literate. This discrepancy arises from "literate" meaning at times a "minimal" literacy level and at others meaning a very high literacy level.

The tradition of scientific literacy, and related forms such as technological literacy, economic literacy, and geographic literacy, to name only a few, suggests that the term literacy is mostly a matter of being informed rather than a communication skill. Both scientific literacy (44) and technological literacy have generally been defined as scientific and technical knowledge pertaining to social implications. Thus, for example, scientific literacy does not refer just to one's knowledge of biology, or more generally, the science-society interface. It is no wonder that in the computer literature the term computer literacy is equated with "computers and society."

We have proposed a definition of computer literacy which incorporates knowledge of computers, social implications of that knowledge, and also recognizes the need for skills in communicating with computers (3). Computer literacy, in our definition, is "whatever understanding, skills, and attitudes one needs to function effectively within a given social role that directly or indirectly involves computers." It should be clarified that we interpret "function effectively" within roles to be a matter of well-being and personal comfort, not just rational goal attainment. For the purpose of this article we apply the term "computer literacy" to the two most general roles--citizen, and, by implication, student.

The school is the main institution for socialization in citizenship; thus, it is appropriate that computer literacy education be provided to future citizens as early as junior high school. It is imperative that students learn not only what every citizen needs to know about computers but what every student needs to know for doing effective schoolwork. The need to combine education requirements of citizens and students implies that a broad spectrum of computer literacy is necessary. Students need to know how to use the computer as a tool in their schoolwork, and they need to know about the limitations, general capabilities, and social implications of computers for coping with computerization in their everyday lives.

This definition of computer literacy is quite compatible with most of the literature on the computer literacy concept. For instance, Moursund defined literacy as the "non-technical and low-technical aspects of the capabilities and limitations of computers, and of the social, vocational, and educational implications of computers" (41). This philosophy is effectively embodied in computer literacy texts for elementary students by Ball and Charp (10); and for secondary students by Billings and Moursund (13), and others. Those writing on the definition of computer literacy--for example, Rawitsch (47) and Thomas (51)--have expanded upon this approach to elaborate specific requirements in various arenas.

Our approach to computer literacy is broader than most. Some writers argue in favor of equating computer programming instruction with computer literacy (30). Others view computer literacy as just general knowledge about the role of computers in society. We believe that to function effectively as a citizen in the 1980's and beyond, one needs to know about the role of computers in society; and to function effectively as a student (in high school and above), one needs to know the elementary concepts and techniques of computer programming. Thus, a true computer literacy program should include these social elements as well as whatever else is needed to understand and be able to use computers in some minimal and meaningful way

Computer Literacy Objectives

Our objectives for computer literacy are listed as an appendix to this article. The list of objectives is categorized into eight areas or domains and these are summarized as follows:

1. APPLICATIONS. This area covers the multitude of social and organizational areas into which computers have been integrated. It also covers the general considerations for applying computers to new situations.
2. HARDWARE. This domain deals with the basic vocabulary of computer system components. Just how extensive this knowledge should be depends upon the social role of the learner.
3. IMPACT. This domain encompasses the social effects of computerization, including both the positive and negative impacts of computers on society.
4. LIMITATIONS. This domain is distinguished from the applications domain because of the focus on developing a general sense of the capabilities and limitations of computing machines. Examples of computer limitations include the facts that computers do not have feelings and consciousness, nor are they able to make value judgments.
5. PROGRAMMING/ALGORITHMS. This domain deals with the ability to read, modify, and construct algorithms and programs.
6. SOFTWARE AND DATA PROCESSING. This area includes vocabulary relevant to software, information processing, and data.
7. USAGE. While the foregoing areas are largely cognitive in emphasis, this domain involves motor skills for sequencing and execution of certain tasks on the computer or computer terminal.
8. VALUES AND FEELINGS. The effective domain centers on developing positive attitudes toward personal use of computers as well as balanced attitudes toward computers as a social force.

For the cognitive objectives, the first digit after the letter refers to a cognitive level--1 indicates a low level, generally a skill or knowledge of facts; 2 indicates a higher level of understanding, requiring some analysis and/or synthesis. The final digit is merely a count of items within each level, in some sort of logical sequence. For the psychomotor and affective objectives, the first digit is merely for recording purposes--no attempt was made to suggest any priorities.

The detailed objectives within each of the eight categories follow.

Applications (A)

A.1.1. Recognize that computers and computer-supported applications are used in a wide variety of ways to assist individuals, groups, and institutions.

A.1.2. Recognize specific uses of computers or computer-supported applications in many of the following areas:

a. medicine and health care
b. law enforcement and criminal justice
c. education and training
d. engineering and design
e. business and banking
f. the office
g. transportation and traffic control
h. defense systems
i. weather prediction
j. recreation
k. government and politics
l. the home
m. the library
n. manufacturing
o. the creative arts
p. publishing
q. public utilities--telephone and power plants.

A.1.3. Recognize that the following are common types of computer applications, and be able to give an example of each type:

a. information storage and retrieval--record-keeping, data bases, etc.
b. simulation and modeling
c. process/machine control--robotics
d. computation (numerical/statistical analysis of data)
e. data processing
f. word processing
g. graphics
h. speech synthesis
i. artificial intelligence.

A.1.4. Recognize the definition of and some advantages of computer simulation.

A.1.5. Recognize that computers are generally useful for information-processing tasks which require any of the following:

a. handling large amounts of information
b. rapid handling of information
c. accuracy
d. repetition
e. storage of information in an accessible form.

A.1.6. Recognize that some of the more important factors which limit and/or restrict computer use include:

- a. cost (hardware, software, maintenance, conversion, etc.)
- b. people's attitudes (fears, anxieties)
- c. unavailability of suitable software/applications
- d. hardware limitations--storage limitations, lack of peripherals, etc.
- e. complexity of some computer-supported applications.

A.1.7. Recognize that innovations in computer hardware and software continually expand the potential utility of the computer.

A.1.8. Identify some of the features of a computer-supported application which make it easy to use.

A.1.9. Recognize some advantages of using a computer for storage and retrieval of information (including continual updating and quick recall).

A.1.10. Recognize features and capabilities of personal microcomputer systems as compared to features and capabilities of large data process systems.

A.2.1. Determine how computers and computer-supported applications can assist an individual as he/she plays various roles, i.e., consumer, worker, citizen; how such systems assist groups and organizations as they attempt to accomplish tasks and responsibilities.

A.2.2. Assess the feasibility, potential benefits, and hazards of a computer-supported application (cross-reference in impact).

A.2.3. Design and develop a computer-supported application that would be personally useful.

A.2.4. Recognize some general criteria for computer usage for a particular task (e.g., purpose, time and resource constraints, ethical or moral considerations, relevance).

Hardware (H)

H.1.1. Recognize that computer hardware refers to the physical components of computer systems.

H.1.2. Recognize that chips are small pieces of silicon that contain electronic logic networks called circuits, and that a computer can be made up of chips mounted on boards.

H.1.3. Identify at least five major functions of a general purpose computer system, namely input, output, storage or memory, control, arithmetic, and timing or clocking.

H.1.4. Recognize that CPU stands for Central Processing Unit, which is the part of the computer which carries out the essential and controlling tasks. The arithmetic, control, and memory units of a computer are generally regarded as comprising the CPU.

H.1.5. Recognize that the term "mainframe" refers to the CPU and its enclosure or to large computers.

H.1.6. Recognize that a microprocessor is a single chip containing all the electronic logic of a CPU.

H.1.7. Recognize that a microcomputer is a very small computer that uses a microprocessor for its Central Processing Unit.

H.1.8. Recognize that minicomputers are a range of computers larger than microcomputers and smaller than what is usually called "mainframes."

H.1.9. Identify the meaning of acronyms including ROM, RAM, PROM, EPROM, which identify different types of memory.

H.1.10. Recognize the characteristics of secondary storage systems including magnetic tapes, floppy disks, etc.

H.1.11. Recognize that keyboards, punchcards, tapes serve as input devices.

H.1.12. Recognize that display screens, printers, punchcards, tapes serve as output devices.

H.1.13. Recognize the function of some basic communications technology, e.g., networks, distributed networks, modem or acoustic-coupler.

H.1.14. Distinguish parallel and serial communications.

H.1.15. Recognize the rapid growth of computer hardware since the 1940s.

H.1.16. Recognize the distinctions among the following terms: bit, byte, register, and word.

H.1.17. Recognize both the loose and the precise definition of "K."

H.1.18. Distinguish and be able to identify special purpose from general purpose computers.

H.1.19. Identify similarities and differences between programmable calculators and computers.

H.1.20. Distinguish analog and digital computing operations.

Impact (I)

I.1.1. Describe some of the more common computer-related careers such as computer programmer, systems analyst, computer scientist, computer operator, key operator.

I.1.2. Recognize that computers and computer-supported applications have a major impact on the way ordinary citizens live, work, and play.

I.1.3. Recognize that for at least the short-term future, computers will continue to be made smaller while the amount of information they can hold will continue to increase.

I.1.4. Recognize that computers are used to commit a variety of serious crimes, especially stealing money and stealing information.

I.1.5. Recognize that identification codes (numbers) and passwords are a primary means for restricting use of computer systems, of computer programs, and of data files.

I.1.6. Recognize that procedures for detecting computer-based crimes are limited.

I.1.7. Identify some advantages or disadvantages of a data base containing personal information on a large number of people (the list might include value for research and potential for privacy invasion).

I.1.8. Recognize several regulatory procedures (e.g., privilege to review one's own file and restrictions on use of universal personal identifiers) which help ensure the integrity of personal data files.

I.1.9. Recognize that "privacy problems" are characteristic of large information files whether or not they are computerized.

I.1.10. Recognize that computerization both increases and decreases employment.

I.1.11. Recognize that computerization can personalize and impersonalize procedures in fields such as education.

I.1.12. Recognize that computerization can lead to both greater independence and dependence upon one's tools.

I.1.13. Recognize that alleged "computer mistakes" are usually mistakes made by people.

I.2.1. Plan a strategy for tracing and correcting a computer-related error such as a billing error.

I.2.2. Explain how computers make keeping track of people more feasible.

I.2.3. Recognize that even though a person does not go near a computer, he or she is affected indirectly because the society is influenced by computerization.

I.2.4. Explain how computers can be used to impact the distribution and use of economic, social, and political power.

I.2.5. Identify and evaluate the positive and negative consequences of computer use in specific situations.

Limitations (L)

L.1.1. Recognize that computers are machines designed, built, and operated by humans to assist in many tasks.

L.1.2. Recognize that computers cannot make value judgments.

L.1.3. Recognize that computers cannot provide answers to every question.

L.1.4. Recognize that despite "artificial intelligence," computers cannot think in the way that the word "think" is normally used.

L.1.5. Identify a number of things that computers cannot do or cannot perform efficiently.

L.2.1. Distinguish major differences between capabilities and computer capabilities.

Programming/Algorithms (P)

P.1.1. Recognize the definition of algorithm and that flowcharts and programs are alternative forms for expressing algorithms.

P.1.2. Follow and give the correct output for simple algorithms expressed in words, flowcharts, or structure diagrams. The algorithms would include some or all of the following: replacment; calculation; selection (decision points); repetition (simple looping with iteration/recursion); input and output operations.

P.1.3. Given a simple algorithm, explain what it accomplishes, i.e., be able to interpret and to generalize. As in P.1.2. the algorithm could include replacement, calculation, selection, repetition, and input/output.

P.1.4. For simple programs written in a language such as BASIC or PASCAL, follow and give the correct output for the program. The programs would contain input/output, replacement, calculation, selection, and repetition.

P.2.1. Modify a simple algorithm or program to accomplish a new, but related, task. This would include changing one or two statements to solve a similar problem, and adding more statements to accommodate additional requirements.

P.2.2. Detect syntax and logic errors in an improperly functioning algorithm or program.

P.2.3. Correct syntax and logic errors in an improperly functioning algorithm or program.

P.2.4. Develop, with appropriate documentation, an algorithm or program for solving a specific problem.

P.2.5. Select an appropriate algorithm from a set of alternatives using criteria such as efficiency, elegance, and appropriateness.

Software and Data Processing (S)

S.1.1. Identify that software refers to computer programs and includes operating systems, compilers, and user (application) programs.

S 1.2. Recognize that digital computers operate upon information which has been encoded in binary, the coding system which can utilize the base 2 number system.

S.1.3. Recognize that a computer needs instructions to operate.

S.1.4. Recognize that a computer gets instructions from a program written in a programming language by a person.

S.1.5. Recognize that computer programs are sets of sequential instructions which perform many tasks such as printing, sorting, calculating.

S.1.6. Identify that the basic elements of an information processing system are input, processing, and output, in that order.

S.1.7. Identify the fact that data are symbols representing things.

S.1.8. Identify the fact that information is data which have been given meaning.

S.1.9. Identify the fact that communication is the transmission of information via coded messages.

S.1.10. Identify the need for data to be organized in order to be useful.

S.1.11. Identify the fact that data processing involves the transformation of data by means of a set of predefined rules.

S.1.12. Recognize that computers process data by searching, sorting, deleting, updating, summarizing, moving.

S.1.13. Recognize that software refers to any nonpermanent sets of programs, whereas firmware refers to software that has been made physically permanent.

S.1.14. Recognize that an operating system is software or firmware that performs file managing tasks such as loading programs, copying files.

S.2.1. Select an appropriate attribute for ordering of data for a particular task.

S.2.2. Design an elementary data structure for a given application (that is, provide order for the data).

S.2.3. Design an elementary coding system for a given application.

Usage (U)

U.1.1. Connect a microcomputer or computer terminal to a power source and available storage units such as disks or tapes.

U.1.2. Interact with a computer in an online instructional learning situation involving drill and dialogues.

U.1.3. Use system commands for an available computer system (e.g., command to load, list, execute, save, and purge files).

U.1.4. Use program documentation to select and run library programs for specific tasks.

U.1.5. Enter, compile, and debug a simple stored program written in a "higher-level" language.

Values (V)

V.1.1. Does not feel fear, anxiety, or intimidation from computer experiences.

V.1.2. Feels confident about his/her ability to use and control computers.

V.1.3. Enjoys and desires work or play with computers, especially computer-assisted learning.

V.1.4. Describes past experiences with computers with positive-affect words like fun, exciting, challenging.

V.1.5. Given an opportunity, spends free time using a computer.

V.1.6. Values the potential role of computers in meeting societal and institutional needs (e.g., making full, accurate information available for relevant decisions, problem solutions, or inquiries by private individuals; handling routine data collection/processing/monitoring tasks efficiently).

V.1.7. Values efficient information processing provided that it does not neglect accuracy, the protection of individual rights, and social needs.

V.1.8. Values computerization of routine tasks so long as it frees people to engage in other activities and is not done as an end in itself.

V.1.9. Values increased communication and availability of information made possible through computer use provided that it does not violate personal rights to privacy and accuracy of personal data.

These objectives have been used as the basis for the development of an assessment instrument designed to measure computer awareness, knowledge, and attitudes among secondary school students. In addition, they have provided a foundation for the development of instructional materials designed to foster computer literacy. Information concerning both these projects is available from the Minnesota Educational Computing Consortium, 2520 Broadway Drive, St. Paul, MN 55113.

Conclusion

The growing reliance of our society upon computer systems demands that the public come to understand this phenomenon. Our schools are charged with the responsibility to develop instructional programs in computer literacy, which is generally understood to refer to the level of knowledge and skill a person needs to function effectively in a computerized society. Although not everyone agrees on what that knowledge consists of, it is possible to define the major components or dimensions of computer literacy. We have attempted to provide information concerning computer literacy which will be helpful to educators preparing or complementing instruction designed to promote computer awareness and understanding. In keeping with this objective, we conclude with a rather extensive list of references.

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HARDWARE SELECTION AND EVALUATION

By Gary G. Bitter

Picture yourself in a candy store standing in front of long glass cases displaying jars of rainbow-colored gumdrops, tins of imported chocolates, strings of licorice, and dozens of other confectionary delicacies. You have a quarter to spend, and it is very important to you to make the right choices and get the most you can for your 25¢. The problem is that everything you see is so enticing that you simply cannot decide what to buy.

Many people who are faced with the task of purchasing computer hardware for educational applications find themselves in exactly this position. There are myriad types and brands of computers, each with particularly attractive features of its own. To further complicate matters, there is an even wider range of peripherals (accessory equipment other than the main computer) that enhance the capabilities of today's microcomputers. Add to that the unfortunate fact that many computer salespeople are not fully informed of the capabilities of the hardware they sell--not surprising when even experts in the field of educational computing offer conflicting advice. What you have is a perplexing puzzle made up of hardware and software pieces that you must fit together into a complete and clear picture of educational computing.

But if the puzzle is perplexing, it is also intriguing in its challenge. The key to solving the puzzle lies in first determining what you expect from the microcomputer in the corner of your classroom. How will it function? How do you intend to use it? Once you answer these questions, you can begin shopping with a clear idea of what features are most important to you.

Because the selection of educational software is limited, it is ideal to consider hardware and software simultaneously. Many people have experienced the frustration of purchasing an excellent CAI software package only to discover that they do not have access to the hardware required to run the program. A firm decision about the kind of software you want to use in your classroom will help to limit your choice of microcomputer systems since many programs are designed specifically for use with particular brands of computers.

It is vitally important that you anticipate the uses your computer will serve before you begin visiting computer stores and talking with sales representatives. The number of applicatons of computers in educational settings is virtually limitless, and you will want to purchase a computer with the features required for the applications you have in mind. Some of the uses that computers serve in schools are:

--Programming instruction

--Computer literacy classes

--Testing and test banks

--Computer-aided instruction

--Computer-managed instruction

--Simulation of dangerous or difficult laboratory experiments

--Laboratory instruments that measure quantitative values

--Music composition and training

--Word processing instruction in business education classes

--Word processing in English composition classes

--Accounting instruction

--Administrative functions

--Guidance (especially accessing national data bases)

--Library procedures

--Basic electronics instruction (assembling computers from kits)

--Graphics design

--Math instruction including computer programming

--Locating research sources

--Simulations for political science, social studies, and economics classes

--Statistical interpretation of data

--Individualized G.E.D. instruction

--Student newspapers

--Worksheet and puzzle generation

--Determining readability levels of textbooks and other instructional materials

--Vocational training

Once you have determined the purposes that your computer will serve, survey the software available for these applications. Find out how software availability limits your choices of hardware. Of course, there is an alternative to purchasing prepackaged software. If you choose to develop your own educational software, you will have a wider range of hardware choices. The drawback to developing your own software is the time, money and effort that this endeavor requires.

Perhaps your school district is interested in developing software for district-wide use. Software developed within your system may be shared, traded, and sold, an advantage of software development. This also helps to standardize computer education programs within a given school district. If you decide to follow this course, you should be realistic about the process of software design. It requires a substantial amount of time and expertise. The district may need to hire outside consultants who have more computer expertise than classroom teachers can reasonably be expected to have. Classroom teachers, after all, are primarily responsible for the daily educational experiences of their students. Teachers should never be expected to develop educational software in their spare time, a rare luxury for most teachers. Instead, the school district must be willing to allocate the large amount of human and monetary resources required for software development.

Assuming that you do not choose to develop your own software and you have researched the educational software on the market to decide what sorts of programs you will be running, you are now prepared to window-shop. Visit computer retail stores in your area to see what types of hardware they offer for sale. You should also send Request for Information forms to all those manufacturers and retailers who may be considered potential bidders. You will also want to work with others in your district to develop a set of standard district-wide criteria by which to judge and compare the hardware you find on the market. Your criteria should cover a spectrum of important factors:

1. How much money has your district allotted for the purchase of computer hardware? There is a sizeable range of prices of computers, and you may find that a high-price computer is justified by the applications for which it can be used.

2. Who will use the computer? Various users require different design, safety and durability features. For example, any computer intended for use by elementary-school children must be especially "user-friendly."

3. Can the system you are considering be expanded later? If you decide to run a program that requires a great deal of memory, can you purchase additional memory for your computer?

4. How difficult will this system be to maintain? Is maintenance service quickly accessible and relatively affordable? Does the manufacturer or retailer offer a service contract? Is this equipment considered reliable? What are the experiences of other systems who presently operate this equipment?

5. Will it be easy to train teachers to operate this computer system? Does the manufacturer offer to help in the training process and make ongoing support for teachers available? How sensitive is the manufacturer to the special needs of teachers?

6. What languages does this computer support? Most microcomputers run BASIC, but a computer to be used for advance programming instruction should support

additional languages such as FORTRAN and Pascal, among others.

7. What is the size of the video screen display? Word processing applications may require 64 to 80 characters-per-line screen displays, but some microcomputers offer only 24 characters-per-line displays.

8. Is this computer capable of generating graphics? If so, is it necessary that the computer generate low-resolution graphics or must it be capable of high resolution?

9. Does the computer have color capability? While color is superfluous to basic programming classes, many CAI programs are enhanced by the addition of color.

10. Will you require a printer for your applications? If so, can the computer system you are considering be connected to a compatible printer? Word processing classes and programming classes, for example, are lost without printers. Can your district afford to purchase both computer and printer?

11. Is networking available with the computer you are considering? Networking refers to connecting a number of remote microcomputers to a central microcomputer.

This also allows for the use of a central printer, which may represent a considerable savings to the district.

12. Does this computer come with clear and thorough documentation? Is the documentation well indexed for ease of use?

13. Is this computer portable? If one computer is to be moved from classroom to classroom for computer literacy instruction, portability is a crucial feature. If the computer will be permanently housed in one location, this is not so important.

14. Will this computer operate safely and efficiently in the environment in which you will house it? Do you need to purchase additional safety equipment such as antistatic mats to ensure safety and efficiency? In dry climates, for example, computers must be housed in rooms that are not carpeted or else they must be placed on antistatic mats.

15. How is the keyboard of this computer designed? Will it be comfortable for students to use? Some microcomputers have keyboards very similar to a standard typewriter while others have flat, touch-sensitive mylar surfaces. Other have calculator-style keyboards.

Does your application affect the type of keyboard you require?

16. Does this computer allow for fast and simple editing? What is its process for correcting typing errors and inserting words? Small children, for example, require one-step editing procedures. Complicated correction processes are frustrating to many students.

17. Is this computer capable of voice generation? Is this feature necessary or attractive for your applications?

18. How flexible is the computer system you are considering? If your needs change, can you use this system for applications other than those you plan to implement now?

19. Is this system compatible with other computers that your district owns? This has a number of potential advantages, making your computer more cost-effective.

20. Can this computer be interfaced with mainframe computers through telephone lines or cables? This will provide access to national data bases, which will be an important way of obtaining up-to-the-minute information in the future.

Add to this list any other features and concerns that you feel are essential to your choice of hardware. Perhaps you will want to devise a system of numerically scoring the extent to which each microcomputer you evaluate meets these criteria. This will help you make a more objective selection. Consider implementing a district-wide standardized evaluation form so that teachers can share the information they uncover while window-shopping.

Now you are ready to start off for the nearest computer store. To provide you with a fundamental basis for comparison of the hardware you will find there, the following discussion briefly describes a number of types of microcomputers that have already found their way into today's computer-aware classroom setting.

A Survey of Commonly Used Microcomputers

There is a range of microcomputers in common use in educational settings, and several new microcomputers on the market promise to become equally popular. While there is currently a shortage of outstanding educational software to be run on these computers, it is likely that computer manufacturers will concentrate their efforts toward supplying this shortage. As computers become smaller and more affordable, they will be purchased for educational purposes. When this happens, microcomputer manufactuers will respond to the needs of classroom teachers and others for a variety of high-quality educational software. In this section, we will explore some of the features of microcomputers frequently used in educational settings as well as speculating about several machines that are new to the market but promise to become quite popular.

Keep in mind as you read this discussion of popular microcomputers that the computer field changes so rapidly that you will want to consult microcomputer manufacturers themselves for up-to-the-minute information about technology. However, this discussion should provide you with some basis for making intelligent comparisons of microcomputers.

If you are new to the subject of computers, it may be well for you to review the following list of terms pertinent to describing and comparing the features of microcomputers:

Hardware: physical equipment that makes up a computer system.

Software: a set of human-written instructions that tells the computer how to perform specific tasks.

Memory: the physical part of a computer that stores data and program instructions.

RAM (Random Access Memory): computer memory that allows data and instructions to be retrieved in random fashion. The user can alter the contents of RAM at will.

K (Kilobyte): 1,024 characters of data, usually the amount of data that can be displayed at one time on a video screen.

Disk drive: a machine similar to a record player that is capable of reading information stored on a floppy disk. This machine retrieves information randomly.

Cassette recorder: a machine that is capable of reading information stored on cassette tapes. This machine retrieves information sequentially.

Monitor: the computer's video display.

Graphics: computer-generated patterns and artwork used for many Computer-Aided Instruction and other applications.

Low-resolution graphics: computer graphics similar to the effects that can be produced with a standard typewriter.

High-resolution graphics: computer graphics that are more sophisticated and higher-quality than low-resolution graphics.

Speech synthesis: computer recreation of humanlike voice patterns and articulation.

Numeric keypad: an arrangement of keys similar to a 10-key adding machine. The numerals 0-9 are represented, allowing for easy entry of numerical data.

Peripherals: computer hardware other than the central microcomputer system, such as printers, game paddles, disk drives, language cards, etc.

Interfacing: connecting peripheral equipment to the microcomputer.

With this basic computer vocabulary in your grasp, you are prepared to compare the many microcomputer systems available to you. We will organize our discussion by considering various manufacturers and the machines that they offer. (For a graphic comparison of various microcomputers, see Table I.)

Apple

Apple offers two basic computers: Apple IIe and Apple III. Most schools that use Apple computers have purchased the Apple II. Much of the software that has been written for the Apple II--in a form of BASIC called Applesoft--can also be used with the Apple III. The size of Apple IIe memory is 64K RAM. This enables you to run programs with greater capability.

The keyboard of the Apple is very similar to a standard typewriter keyboard, and it may be used either with a regular television set or with a monitor. It has been suggested that the Apple be run only with disk drives since some computer experts feel that cassette storage may be less than reliable.

Besides BASIC, the Apple can run programs in other languages such as FORTH, COBOL, PILOT, FORTRAN, and Pascal. Its screen is capable of displaying 40 characters per line and 24 lines at once. There is a board available that allows the user to view 80 characters per line for applications where 40 characters per line are insufficient.

The Apple is particularly well suited for educational settings because of its full color and sound capabilities that make educational software more attractive to students. With the purchase of additional hardware, the user can even enjoy speech synthesis and networking. In addition, there is a wide range of other peripheral equipment available to broaden the capabilities of Apple microcomputers. These features make the Apple computer very popular in many school settings.

Atari

Atari used to be known primarily for the wide selection of electronic games they offered on the market. With the introduction of PILOT with Turtle graphics, many schools have found that both the Atari 400 and 800 are user-friendly, an attractive feature of computers to be used with small children. Both models accept easily inserted cartridges containing software, and both can be programmed in a variety of languages.

Atari microcomputers are capable of generating sound and music. Both also have upper-case and lower-case letters. Atari offers high-resolution graphics of outstanding quality. Its screen can display 40 characters per line and 24 lines at one time. The Atari is used with either standard television sets or monitors, and it may be connected to a number of peripherals to enhance its capabilities.

The Atari 800 can be purchased with memory ranging in size from 16K to 48K. The memory of the Atari computer can be increased by the simple insertion of a cartridge containing an additional 8K or 16K of memory. Its keyboard is similar to that of a standard typewriter keyboard except that it emits a beep each time it enters a character. The Atari 800 has two slots for inserting software cartridges.

The Atari 400 features a memory that can be expanded to 16K. It is smaller and weighs less than the 800, and its keyboard is a smooth touch-sensitive mylar surface. This type of keyboard is less easily damaged than the typewriter-like style and protects the internal parts of the computer from spillage, dust and other substances that may have an injurious effect.

COMMODORE BUSINESS MACHINES

Commodore 64

Probably the most attractive feature of the Commodore 64 microcomputer is the ease with which the user can learn to operate it. It also can be operated reliably with cassette or disk storage. The user is guided through each step of the process of loading a program by clear instructions that appear on the video screen. The 64 is easily portable, which makes it a good choice for applications in which the microcomputer will be moved from classroom to classroom.

The 64 allows for simple editing of programs. Its keyboard is capable of generating both upper- and lower-case letters, and it has extensive and unique graphics capabilities. It can be used with any of several networking systems.

The Commodore 64 comes with 64K memory. There is a substantial amount of educational software available for use with the Commodore 64. It can also support programs written in LOGO and Pascal. In addition, it can be connected to a wide range of peripheral accessories. All of these features make the Commodore 64 a very popular microcomputer in educational settings.

VIC-20

The VIC is an attractive microcomputer from Commodore with a popular price. It produces upper- and lower-case letters, full-color graphics, and sound capabilities. Although it can only generate low-resolution graphics, the VIC has special graphics characters included on its keyboard. The VIC comes with a small memory of 5K, but this amount can be expanded to 32K for applications that demand more memory. The small display may prove frustrating to serious students of programming, and this is a considerable disadvantage of the VIC. Its small size and graphics capability combined with its relatively inexpensive purchase price have made the VIC a popular microcomputer for home and school settings.

The Super Pet

True to its name, the Super Pet is a superior computer for many applications. Its video screen displays 80 characters per line and 25 lines at one time. Its memory size reaches to 96K, making it very powerful for such a small machine. The programming student can easily choose from APL, BASIC, FORTRAN, Pascal and Assembler, all of which are contained within the console of the computer itself. The Super Pet is easily interfaced with mainframe computers. It arrives with clear and thorough documentation to orient the user to its capabilities.

The keyboard/processor unit and green phosphor monitor are contained within the Super Pet cabinet. It can run software that has been designed for the Pet and the CBM 8032 (a business-oriented Commodore microcomputer) without any modifications. With additional hardware offered by an independent manufacturer, the Super Pet becomes capable of generating high-resolution graphics in black and white. It is not presently capable of color, music or speech synthesis. However, it does possess some sound capability. Its large memory and language flexibility make it an excellent computer for use in advanced computer programming applications.

IBM Personal Computer

A long-time innovator in the field of computers, IBM recently introduced its first personal computer. Some experts consider this microcomputer to be exceptionally well designed. A wide range of hardware and software are available for use with this personal computer. The IBM Personal Computer can be connected to any black-and-white or color monitor or to a standard television set. Its memory size is extremely flexible; it can be expanded to 512K. The IBM Personal Computer is compatible with a variety of disk drives, printers and other peripherals.

Its video screen displays 80 characters per line and 25 lines at one time. The typewriter-style keyboard generates both upper- and lower-case letters and is even capable of underlining. The IBM Personal Computer generates colorful high-resolution graphics of outstanding quality, and sound capability is a standard feature. It supports programs written in BASIC and Pascal as well as APL. Additional hardware purchased from other manufacturers can further enhance this microcomputer's capabilities with speech synthesis and networking potential. The IBM Personal Computer comes with clear and explicit documentation.

Radio Shack Computers

With the introduction of its TRS-80 Model I in 1977, Radio Shack began to make a name for itself in the field of microcomputers. Its great success is due in part to the many Radio Shack outlets available to sell and maintain their computers. Since its introduction, the TRS-80 has been enhanced by a wide range of peripheral equipment designed by Radio Shack and other manufacturers.

Radio Shack displays interest in educational applications of microcomputers and even offers cost-free lessons in BASIC for teachers and others involved in education. Radio Shack documentation is noted for its clarity and simplicity.

TRS-80 Model III - Model IV

The TRS-80 Model III and IV are all-in-one microcomputers. Disk drives, cassette recorders and printers must be purchased separately. The keyboards are similar to that of a standard typewriter. Their video screen displays 64 characters per line and 16 lines at one time, making this model a good choice for word processing applications. In addition, it is capable of speech synthesis and networking.

Although the TRS-80 Model III and Model IV are only capable of low-resolution black and white graphics, they do include special graphics characters and a numeric keypad.

TRS-80 Color Computer

The TRS-80 Color Computer is built in a modular design with a keyboard unit that can be connected to any black-and-white or color television set. The 4K Color Computer can be expanded with the purchase of additional memory. Its video screen displays 32 characters per line and 16 lines at one time. The TRS-80 Color Computer is capable of high resolution graphics and comes with sound capability as a standard feature. It includes a calculator-style keyboard. It can be operated with either disk or cassette storage.

Currently, there is not a great deal of software available for the TRS-80 Color Computer. As this microcomputer becomes more prevalent in home and school settings, however, this is likely to change. More software will be offered in the future.

TEXAS INSTRUMENTS

TI 99/4

In 1979, Texas Instruments introduced its TI 99/4, advertised primarily as a home computer. It runs plug-in ROM cartridges that generate high-quality and vividly colored graphics. Its plug-in design makes it simple for even small children to use, lending to its popularity in home applications. It can be operated with disk or cassette storage, in addition to preprogrammed ROM cartridges. An excellent speech synthesizer can further enhance the TI 99/4.

The video screen of the TI 99/4 displays 32 characters per line and 24 lines at one time. It generates upper-case letters only. It is capable of high-resolution graphics, and its sound system is notably well-designed. It has a calculator-style keyboard that has proven nonthreatening to small children who have not yet learned to type. Its editing procedures are relatively complicated.

Unfortunately, there is a shortage of educational software that can be run on the TI 99/4. In addition to supporting TI BASIC, however, this microcomputer can also run programs in LOGO, a simple language designed especially for educational applications. This feature makes the TI 99/4 an attractive choice for educational settings where small children will be operating computers.

TI 99/4A

The TI 99/4A is a new model offered by Texas Instruments. Possessing the same capabilities as the TI 99/4, the TI 99/4A enjoys the advantage of an improved keyboard design. The keyboard/computer has memory ranges in size from 16K to 48K. Monitors and peripheral hardware must be purchased separately.

Xerox 820

The Xerox 820 was designed primarily for business office environments. Included are the computer, a twelve-inch black-and-white video screen, and two disk drives. Its video display is 80 characters per line and 24 lines at one time. While it does not possess color or sound capability, the Xerox 820 does generate low-resolution graphics. This microcomputer was designed specifically to run a large amount of CP/M software already in existence, so the user has a good selection of business and word processing software to choose from. Additional hardware from another manufacturer makes the Xerox 820 capable of networking. Its typewriter-style keyboard includes a convenient numeric keypad.

Xerox's main thrust has been the business field, and so little or no educational software exists for use with the Xerox 820. The microcomputer is still relatively new, though, and cannot be fully evaluated until it has received a considerable period of consumer use.

Summary

Today's microcomputer market offers the prospective computer user a wide range of machines with a number of attractive features. The wisest way to approach shopping for the computer that will best meet your needs is to determine exactly how your computer will be used. This will help you to decide which features are most important to you. Once you have narrowed down your list of prospects to several likely candidates, you will find it much easier to make your final choice. Keep in mind also that your choice of microcomputers should be made in conjunction with your choice of software to assure compatibility.

TABLE 1:

Major Features of the Apple IIe Microcomputer

Memory range	64K
Keyboard	standard typewriter
Type	upper-case letters (can be modified for lower-case also)
Languages	BASIC, FORTH, COBOL, PILOT, FORTRAN, LOGO, Pascal and others
Video display	40 characters-per-line 24 lines-per-screen (can be modified for larger display)
Special features	full color and sound capabilities

TABLE 2:

Major Features of the Atari 400 and Atari 800 Microcomputers

	Atari 400	Atari 800
Memory range	up to 16K	16K - 48K
Keyboard	touch-sensitive mylar surface	standard typewriter
Type	upper- and lower-case	upper- and lower-case
Languages	accepts programmed cartridges in several languages	accepts programmed cartridges in several languages
Video display	40 characters-per-line, 24 lines-per-screen	40 characters-per-line, 24 lines-per screen
Special feature	High-resolution graphics	High-resolution graphics

TABLE 3:

Major Features of the COMMODORE 64 Microcomputer

Memory range	64K
Keyboard	standard typewriter with special graphics characters
Type	upper- and lower-case letters
Languages	BASIC, PILOT, Pascal
Video display	40 characters-per-line 25 lines-per-screen
Special feature	graphics capabilities

TABLE 4:

Major Features of the COMMODORE VIC-20 Microcomputer

Memory range	5K - 32K (can be expanded by adding mother boards)
Keyboard	standard typewriter with special graphics characters
Type	upper- and lower-case letters
Languages	BASIC, PILOT, Pascal
Video display	22 characters-per-line 23 lines-per-screen
Special feature	graphics capabilities

TABLE 5:

Major Features of the COMMODORE Super Pet Microcomputer

Memory range	up to 96K
Keyboard	standard typewriter
Type	upper- and lower-case letters
Languages	console contains APL, BASIC, FORTRAN, Pascal and Assembler
Special Feature	sound capability

TABLE 6:

Major Features of the IBM Personal Microcomputer

Memory range	64K - 512K
Keyboard	standard typewriter including foreign punctuation marks and APL symbols
Type	upper- and lower-case letters with underlining capabilities
Languages	BASIC, Pascal, APL
Special features	high-resolution color graphics; sound capability

TABLE 7:

Major Features of the TRS-80 Model III and IV Microcomputer

Memory range	16K - 32K
Keyboard	standard typewriter and numeric keypad
Type	upper- and lower-case letters
Language	BASIC
Video display	64 characters-per-line 16 lines-per-screen
Special features	speech synthesis; networking; low-resolution black-and-white graphics

TABLE 8:

Major Features of the TRS-80 Color Computer

Memory range	begins at 16K
Keyboard	calculator-style
Language	BASIC
Video display	32 characters-per-line 16 lines-per-screen
Special features	high-resolution graphics; sound capability

TABLE 9:

Major Features of the TI 99/4 and TI 99/4A Microcomputers

	TI/99/4	TI 99/4A
Memory range	uses plug-in ROM cartridges	16K - 48K
Keyboard	calculator-style	improved TI 99/4 design
Languages	TI BASIC, LOGO	TI BASIC, LOGO
Video display	32 characters-per-line, 24 lines-per-screen	32 characters-per-line, 24 lines-per-screen
Special features	full-color graphics; well-designed sound system; user-friendly	full-color graphics; well-designed sound system; user-friendly

TABLE 10:

Major Features of the Xerox 820 Microcomputer

Memory range	64K
Keyboard	standard typewriter with numeric keypad
Language	runs existent CP/M software
Video display	80 characters-per-line, 24 lines-per screen
Special feature	designed particularly for business and word processing applications

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SOFTWARE FOR YOUR COMPUTER
DESCRIPTIONS AND EVALUATIONS

By Gary G. Bitter

Although computers are very powerful machines capable of performing any number of tasks, they are virtually useless without appropriate software, the human-written set of instructions that tell a computer how to accomplish the work it is given to do. This is especially true of computers in the classroom. With the aid of intelligently written software, the computer is an extremely useful instrument of learning. Without such software, the computer cannot be used to its fullest potential. At first perusal of the vast quantity of computer software offered on the market for sale, you may think that you need a degree in computer science to make wise and cost-effective choices about what software to use with your particular microcomputer. This is not the case, however. With an understanding of a few basic concepts of software, you can purchase the software that will maximize your classroom computer experience.

First, you must determine precisely how you envision your classroom computer will perform. There are two fundamental approaches to computer education (Zalewski, et al., 1982). Some teachers prefer to have students use the computer either to program or to perform a specific function. In this case, students often design their own software during the course of the learning experience. Other teachers use computers to supplement traditional teaching methods. This system is called Computer-Aided Instruction (CAI). The teacher who uses CAI is faced with the task of choosing from among the many software products available in order to design a curriculum that meets the needs of students effectively.

To make wise choices about software purchases, you need to have a clear idea of what you wish the computer to do (Bitter, 1983). There are several types of CAI software from which to choose. The grade level and the ability level of your students will help you to determine what type of software will be most effective in teaching your students.

Drill and Practice Software

By far the most common type of CAI software available is drill and practice software. This type of program randomly generates practice exercises for students to complete. The simplest kind of drill and practice program simply displays the problems, allowing the student to enter an answer. The computer then reports whether the student's response is correct or incorrect.

More sophisticated drill and practice programs tap some of the computer's other capabilities: graphics, animation, and sound, for example. These features help to-keep students' interest and encourage them to use drill and practice programs over and over. This helps to avoid one of the pitfalls of drill and practice software: some programs are boring after one use. Some drill and practice software limits the amount of time a student has to enter a response.

Drill and practice programs include some method of informing students that their responses are correct and of rewarding or positively reinforcing correct answers. They may do this by addressing the student by name (small children especially enjoy this feature), by playing cheerful tunes, or by displaying moving cartoon characters.

Not only do drill and practice programs reinforce mathematical concepts, but they can also be effective in building vocabulary in English as well as in foreign languages, teaching chemistry, enhancing music lessons, and improving a student's grasp of practically any subject taught in a traditional curriculum. The computer is particularly well-suited to this sort of task because it is infinitely patient and repetitive. It allows students to progress at their own rates of speed.

Tutorial Software

Another popular kind of CAI software is the tutorial program. This software introduces new concepts to students and may also offer drill and practice based on the concepts presented. Tutorial programs often include pre- and post-tests so that skills acquired by the students can be measured. Tutorial software is sometimes difficult and time-consuming to design and write because it must take into account various levels of student ability.

For this reason, intelligently designed tutorial programs are often hard to find. Good tutorial software is worth the effort required to locate it, though. Tutorial programs are most often used for enrichment and review of concepts that the teacher has already introduced by traditional means. It is not likely, as many people fear, that this type of computer interaction will replace the human relationship between teacher and student because the computer can make only simple logical distinctions (yes/no), and it lacks the human element that teachers provide.

Simulation Software

Perhaps the most promising field of CAI software is simulation software, which recreates a "real life" situation so that students may experience a given set of conditions. In a simulation setting, students must make choices and then deal with the consequences of those choices. This teaches the vital skill of decision-making. Often, joysticks and paddles are used to manipulate characters and figures that appear on the video screen. Situations like elections, operations of nuclear power plants, life on the frontier, and space travel can be recreated by simulation software. Besides being able to recreate conditions similar to those that occur in reality, simulation software can recreate imaginary settings that keep students interested in the material being presented.

Because it often includes graphic and audio effects, simulation software makes good use of the full capabilities of the microcomputer. For this same reason, it is difficult and time-consuming to design and write. The future offers great potential for growth in the field of simulation software. Indeed this is probably the most promising type of CAI software being developed.

Computer-Managed Instruction Software

To make the most of the computer in your classroom, you may choose to use if for purposes other than teaching.

There is a good deal of software available that enables your microcomputer to relieve you of a number of the routine and laborious record-keeping tasks that face you daily. You will want to survey this software, which is categorized as Computer-Managed Instruction (CMI) software.

You will find CMI software helpful to you in measuring your students' skills. When appropriate, CMI programs direct students to other parts of CAI programs or to other programs entirely. Or CMI programs may suggest that students confer with the teacher for additional help. In some cases, the CMI program can make assignments in related workbooks and textbooks. They can keep track of each individual student's progress as well as monitoring the progress of the class as a whole.

Unfortunately, high-quality CMI software is often difficult to obtain. The quality of such software can only be accurately determined after the software has been implemented and used for some period of time. This makes the purchase of CMI software risky. However, the time and energy saved by good CMI software more than compensate for the effort expended in acquiring it. Teachers who use CMI software are freed from routine and trivial tasks to spend more time giving individual assistance to students.

Because of its complex nature, CMI software is expensive and time-consuming to develop. It may require the joint efforts of several programmers. For these reasons, most quality CMI software is developed at large publishing houses.

Administrative Applications

Appropriately chosen software makes your microcomputer an extremely versatile tool in the classroom. Aside from helping you teach and monitoring the progress of your students, your microcomputer can also relieve you of some of the administrative tasks that you and other school personnel must perform routinely. One such task is record-keeping, a chore that seems to become more time-consuming each year.

You should consider purchasing software that will help you keep track of grades. The microcomputer can be used to record grades and to store grades in a nontraditional "gradebook." The computer is capable of realphabetizing your students' grades whenever the need arises. It can also average an individual student's grades or the grades of an entire class with amazing speed and accuracy.

Still another application of this type of software is in helping teachers compose mandatory IEPs (Individualized Educational Programs). The microcomputer can simplify this task by administering tests, scoring these tests, storing results and generating reports that can be used as an accurate basis for writing IEPs.

You may also purchase microcomputer software that will help you create tests or practice exercises without requiring that you have an extensive knowledge of programming languages. In addition, you can use your microcomputer to keep detailed records of attendance, account for lunch money, maintain a current inventory list, keep track of supply requisitions, monitor field trip expenses, and aid in organizing P.T.A. activities. Indeed, the number of potential applications of such software is limitless.

The safest way to assure that you choose the best CMI software available is to compare a number of programs. You can do this talking with a variety of sales representatives. Also, contact other schools that are currently using this kind of software. Find out what programs they use and ask what problems they have with their systems. You can gain a great deal of insight from their experiences.

Special Programming Languages

Another issue to consider before beginning to purchase software is what computer language you will be using. In addition to the numerous professional computer programming languages, there are several languages that have been designed especially for use in an educational setting. Among these are LOGO and PILOT.

LOGO is a relatively simple programming language that can be used by very young children. It was designed and developed by Seymour Papert in the Artificial Intelligence laboratories at the Massachusetts Institute of Technology. LOGO has been used successfully with children as young as three years of age. Although it is simple in nature, LOGO can be used to create programs that are relatively powerful. LOGO allows even the youngest student quick and painless access to the microcomputer.

Based on common language, LOGO commands direct figures on a video screen to move about, change colors, and create pictures. Some LOGO machines are actually small robotlike mechanisms that move about on a sheet of paper, drawing lines with a pen. Children must direct the movements of the machine or of the image on the screen to create desired patterns. While commanding the LOGO "turtle" to move in various directions, students learn mathematical and geometrical concepts upon which to base more sophisticated knowledge later.

Another computer language that is well-suited for classroom use is PILOT. Radio Shack, Atari and Apple all offer their own versions of this language. PILOT is especially effective in creating interaction-style programs that are very popular with students. While LOGO is more appropriate for use with elementary students, PILOT is taught primarily to students of intermediate and senior high grade levels.

Searching Out Educational Software

As you begin your search for high-quality and powerful educational software, you have a number of resources available to you. If you consider yourself a novice, you may prefer to begin by surveying the popular computer periodicals available in libraries and computer retail stores. You might even consider suggesting that your school library purchase subscriptions to these magazines so that they will be available to students as well as to teachers.

Following is a list of periodicals to review:

AEDS Monitor

Apple Orchard

Classroom Computer News

Compute

Computers in Math and Science Education (mostly geared to high school and college)

The Computing Teacher

Creative Computing (The articles are sometimes too difficult for the beginner but it is a good source for hardware and software ads and for current information.)

C.U.E. Newsletter

Educational Computer

The Electronic Classroom

Electronic Education

Electronic Learning

Infoworld

Nibble

Personal Computing

Popular Computing (originally On Computing)

Teaching and Computers

Turtle News

If you have some amount of experience with computers, you may choose to read several of the more sophisticated professional journals devoted to computer science as well as magazines that are limited to coverage of specific brands of computers. This will provide a sound basis for comparing software and hardware. Take advantage of courses or in-service workshops that your school district offers for teachers working with computers.

You will also want to seek out opportunities for hands-on experience with computers. Several sources of such activities may be computer stores, classes offered at local universities, community colleges and technical schools, and private tutoring offered by computer specialists. You may also find that you have access to microcomputers owned by your school district. Many special programs are offered by microcomputer laboratories, microcomputer conferences, and microcomputer seminars. Finally, some computer retail stores offer small, informal classes in computer programming, and you may find these useful.

Visits to computer stores are likely to turn up all sorts of information useful in choosing and purchasing software. Design an evaluation form so that you can swiftly and easily compare the different hardware and software that you find in computer stores. Check to see whether your school district has a standard software evaluation form. Perhaps there is already a file of forms completed by other teachers in the process of designing their computer curricula.

Talk with other computer experts whenever you have the opportunity. Those involved in computer education will be particularly helpful to you since they are aware of current trends in educational software. Don't overlook parents and students who are knowledgeable about computers. They can be an invaluable source of information.

Whenever possible, try to participate in, or at least attend, decision-making meetings that will have impact on your classroom computer experience. Explore the possibility of applying for state or federal grants to help purchase hardware and software for your classroom. Many such grants are currently available.

As you shop for educational software, remember that many computer programs are designed to be run on a specific brand of computer system. In other words, hardware and software cannot be considered separately. Ideally, you should determine what sort of software you wish to run before you purchase your microcomputer so that you will be assured that your software will be compatible with your hardware.

Evaluating Educational Software

As you begin to acquire knowledge of the types of software available for the applications you have planned, you must develop some criteria by which to evaluate the quality of various programs. Try to answer the following questions when reviewing software.

--Is this software suitable for the grade and ability levels of my students? Will it be too challenging and frustrating? Will it be too simple and boring?

--Does this program require hardware that I do not have access to? (E.g., greater memory capacity, disk drives, language card, joysticks, paddles, printer?)

--Will drill and practice programs be used repeatedly? Is this program sufficiently interesting that my students will want to return to it again and again? Are math problems generated randomly? Can I revise the program easily?

--Does this program allow for typing errors that my students may make? If so, how? Is correction fast and simple?

--Can my students control the speed at which material is presented? Is the program sufficiently flexible to allow for different levels of abilities?

--If my student accidentally presses the ESCAPE key or the RETURN key, does the program end abruptly or does it offer the student a chance to correct this error?

--Does the program address my students by name?

--Does this program offer my students positive reinforcement? Is the positive reinforcement more appealing than the negative reinforcement? Nothing is more disheartening than to discover that your students intentionally respond incorrectly in order to observe the negative reinforcement because it is more entertaining than the positive reinforcement!

--Is the negative reinforcement too critical? Will it discourage students who have difficulty answering correctly?

--Would a workbook or textbook present this material just as well or more effectively than the computer does? If so, implementing this program will be a waste of valuable computer time.

--Is the text that appears on the video screen legible and attractive? Will students have to strain to read it?

--Are graphics used effectively in this program? Will the graphics or animation keep students interested in using the program again and again, thereby reinforcing the skills the program seeks to teach?

--Is this program relatively bug-free? Are there any programming errors that will make this software frustrating to my students?

--If the software (or "courseware," as many large publishers now refer to it) includes other materials such as teacher manuals, student workbooks, and suggested activities, are these materials clearly written and appropriate to the topic being presented?

--Is all documentation accompanying this software clear and thorough?

--Above all, does this program present material in a logical and coherent way? Is the methodology of this software consistent with successful educational techniques?

Again, you should devise a systematic way of comparing the software that you review. A simple standardized form allows you to compare software at a glance. You will want to include your answers to the above questions on your evaluation form. Whenever possible, make your reviews available to other teachers who must evaluate software. This will make everyone's job simpler.

Locating Software for Evaluation

More than likely, you will begin your search for educational software in a computer retail store. You will probably be disappointed with the limited selection that most stores offer. As microcomputers become increasingly popular, this will certainly change and retail stores will offer a wider range of high-quality software products. Do not hesitate to ask the computer salesperson for direction in locating the kind of software you need for your classroom. Many salespeople are familiar with what is available on the market and can guide you toward other sources.

There are two types of computer stores stressing software that are now emerging and are likely to become more popular. One type is The Program Store in Washington D. C. and Baltimore, Maryland. This store offers more than 1,000 pieces of software and three different microcomputers to run and review software. The Program Store plans to open franchises throughout the country within the next several years.

Another type of software outlet is Food for Thought in Tucson, Arizona. Food for Thought is a club requiring membership dues. These dues entitle members to computer

TABLE 1:

Criteria for Evaluating Software for Educational Applications

--Suitable for grade and ability levels of your students?

--Hardware required?

--Interesting enough to encourage repeated use?

--Simple correction and editing procedures?

--Variable speed of presentation?

--Automatic warning of typing errors?

--Capable of addressing students by name?

--Effective positive reinforcement of correct responses?

--Effective negative reinforcement?

--More effective than textbooks or workbooks?

--Legible and attractive video display?

--Effective graphics?

--Relatively error-free?

--Clear and appropriate accompanying materials?

--Concise and thorough documentation?

--Based on sound educational methodology?

time and use of the club's software library. Club members are able to communicate with each other about their projects and interests. People affiliated with groups like this can be an excellent source of information to you as you search for programs to implement in your classroom.

One of your most fruitful sources of information about educational software will be other teachers and administrators who use software similar to that you are now considering. These people have been through the process of locating, acquiring and evaluating software of many kinds. Their experience can benefit you in your own search since they know of software sources and can give you a clear idea of what you should look for.

Educational Software Directories

In an attempt to clear a path through the jungle of educational software, several educational software directories have been published. Although these directories do not attempt to compare or evaluate available software, they do offer fairly comprehensive lists of software sources. The following list of directories should serve as a starting point.

The Apple Software Directory
Volume 3, Education
WIDL Video
5245 W. Diversey
Chicago, IL 60639
312-622-9606

Educational Software Directory
(for Apple II)
Sterling Swift Publishing Co.
P. O. Box 188
Manchaca, TX 78652

School Microware
(for Apple, PET, TRS-80)
Dresden Associates
P. O. Box 246
Dresden, ME 04342

TRS-80 Software Source
COMPUTERMAT
P. O. Box 1664
Lake Havasu City, AZ 86403

Atari Program Exchange
Atari, Inc.
P. O. Box 427
155 Moffett Park Dr.
Sunnyvale, CA 94086

80 Software Critique
RWC Microcomputing Services
P. O. Box 134
El Dorado, CA 95623

Educator's Handbook & Software Directory
(for Apple)
Vital Information, Inc.
350 Union Station
Kansas City, MO 64108

TRS-80 Software Directory
Vital Information, Inc.
350 Union Station
Kansas City, MO 64108

Unfortunately, the ease of copying computer software makes it unprofitable for software developers to distribute examination copies of programs as publishers do with textbooks. However, you may try to obtain copies on a trial basis by writing a letter on the letterhead stationery of your school district, indicating to the publisher who will guarantee the safety of the software, and promising not to pirate the programs. Most software distributors who do not send examination copies do have generous policies of refunding money to customers who find software unsatisfactory. This should relieve some of the pressure to make choices from among the many programs, good and bad, on the market.

When writing to a software publisher, be sure to state your particular needs specifically. When possible, list precise titles of the programs you wish to review. In addition, tell the publisher what subject areas you wish to teach, specific topics that you plan to cover, and what grade level you are teaching. With this information, the publisher can suggest software that will meet the needs you have outlined.

Still another source of information about educational software is microcomputer manufacturers. They may be in the process of developing just the sort of software you want, or they may be able to direct you to other sources of software that can be run on their machines. Microcomputer manufacturers will offer you valuable information about making maximal use of the computer in your classroom.

As microcomputer software becomes a more profitable business venture, major publishers are getting into the act. Sales representatives from these publishing companies will be happy to discuss your software needs and show you the products that their companies offer. Talk to several sales representatives from different publishers so that you know what software is available and how types of courseware differ. Several major publishing companies now offering educational software are McGraw-Hill, Milliken, Scott Foresman, Random House, SRA, DLM, and Addison-Wesley.

Software Review Publications and Organizations

You will find reviews of current software in a number of places. Many popular computer magazines run regular columns and special features that keep tabs on new software as it is produced. Among others, Creative Computing, Nibble Instructor, and Infoworld offer such informative reviews.

There are also a number of organizations that have formed to help direct teachers and other computer users to the best available software. One such project is Microsift, which aims to disseminate software evaluation information. Microsift publishes a newsletter that you will find interesting and helpful as you shop for high quality software. Microsift and a number of similar organizations can be contacted at the addresses below:

Microcomputer Research Clinic
Arizona State University
222 Payne Building (Education)
Tempe, AZ 85287

Microsift News
Northwest Regional Educational Laboratory
300 SW Sixth Ave.
Portland, OR 97204
(503)248-6800

California Software Evaluation Forum
"The 1983 Educational Software Prev. Guide"
Sanmaleo County Office of Education
333 Main Street
Redwood City, CA 94063

TABS Project
Ayss Hall 202-A
1945 N. High Street
Columbus, OH 43210

Project Local
200 Nahatan Street
Westwood, MA 02080

Educational Technology Center
University of California
Irvine, CA 92717
(714)883-6945

Apple Computer Clearinghouse for the Handicapped
Prentke Romich Co.
R.D. 2, P.O. Box 191
Shreve, OH 44676
(216)767-2906

Electronic Data Systems Group
14580 Midway Road
Dallas, TX 75234

Technical Ed. Research Centers
8 Eliot Street
Cambridge, MA 02138

EPIE Institute
P.O. Box 620
Stony Brook, NY 11790
(516)246-8664

Dataspan
University of Michigan
109 E. Madison St.
Ann Arbor, MI 48104
(313)763-4410

Problems with Current Software

As does any new field, software development has a number of problems to resolve. You should beware of some of the pitfalls of educational software that is currently available so that you do not purchase programs that are ultimately more frustrating than useful.

Peter Coburn, et al., (1982) have attempted to point out some of the problems faced by the teacher looking for good educational software. First, there is a plethora of available programs from an infinite number of sources. This can sometimes make shopping for software a hit-and-miss endeavor. To help eliminate some of this confusion, it is likely that on-line data bases will be developed to offer comprehensive lists of software sources. Software reviews may even be made accessible in this form.

Second, there are few programming languages and tools that have been designed especially for use in a traditional classroom setting. As discussed earlier, LOGO and PILOT are two such languages that serve this purpose. Probably this dilemma will resolve itself in the future as software and hardware developers respond to the special needs of classroom teachers.

Third, a majority of the software available now falls under the heading of drill and practice programs. There are too few educational games and simulation programs. This is probably attributable to publishers' reluctance to develop material that is not based on traditional teaching methods. Unfortunately, drill and practice software does not maximize the capabilities of the microcomputer. Teachers can have a substantial impact on the development of more attractive software packages by writing to software publishers and encouraging them to venture out into less traditional methods of presentation.

Fourth, teachers must consider the problem of machine incompatibility when they purchase software. A program written to be run on one brand of computer may not run on another machine. To alleviate this problem, a number of microcomputer manufacturers are now relying on CP/M, a common operating system. The major drawback of CP/M systems is that their initial purchase price is significantly higher than that of popular cassette systems. The higher cost of CP/M has been an obstacle in its adoption in school settings and, consequently, there is a shortage of CP/M-based educational software.

The unfortunate fact is that there is simply a dearth of high-quality software. Much of the software currently available has been developed either by computer hobbyists or by classroom teachers concerned with creating effective instructional materials. The problem with this is that although computer hobbyists have some degree of expertise in computer programming, they usually do not have a thorough knowledge of educational methods. On the other hand, classroom teachers are certainly experts in methodology, but few of them have the programming skills necessary to compose sophisticated software (Zalewski, et al., 1982).

Developing Your Own Software

If you find that you are unable to purchase prepackaged software that adequately meets the needs of your students, you have another exciting alternative: develop your own programs. Of course, the primary disadvantage of developing your own software is that the process is time-consuming and complicated. The planning stage of programming is particularly important. You will want to construct a complete flowchart before beginning to write your program. The time spent in the planning phase will pay off later in a better program with fewer bugs.

If you are writing a relatively simple program that includes true/false and multiple-choice responses, you may use any one of a number of author languages that allow you to write programs without having knowledge of more complex programming languages. Several such languages are PILOT, GENIS I, and TUTOR. You can learn the fundamentals of these languages in a very short period of time.

Should you find that you wish to construct more sophisticated software, you will probably need to study a programming language. You might consider enrolling in a class offered by a local university, community college or technical school. Or you may prefer to teach yourself to program by studying one of the many books written on the subject of various programming languages. BASIC is the most common language used for programming of this nature.

Do not hesitate to call on computer experts for assistance as you begin your programming efforts. Oftentimes, computer students prove helpful. Take advantage of the skills that advanced computer students at local high schools have gained in their classes. Not only will they help you, but they will also gain practical experience in the process.

Probably the most important factor to keep in mind as you write your own software is that your students function at a number of different levels of ability. Plan for contingencies and account for them in your program.

The more flexible your program, the more effective it will be.

If you run into unexpected problems as you write your own programs, you may find it helpful to consult the MECC (1980) publication A Guide to Developing Instructional Software for the Apple II. This excellent book offers a number of practical hints for composing programs that perform the way they are intended to.

Whether you purchase prepackaged software or develop your own, good programs make your classroom computer an extremely effective tool of learning. Computer education is the way of the future. As this trend continues, we will certainly see more and better educational software developing to meet the needs of teachers who want to make the most of the microcomputers in their classrooms.

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Bitter, Gary G. and Camuse, Ruth. Using a Microcomputer In The Classroom. Reston, VA: Reston Publishing, 1983.

Coburn, Peter, et al. Practical Guide to Computers in Education. Reading, MA: Addison-Wesley Publishing Company, 1982.

Zalewski, Donald L., Ed. Microcomputers for Teachers--With Application to Mathematics and Science. School Science and Mathematics Association, 1982.

DESIGNING USER FRIENDLY SOFTWARE

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Fresno, CA 93710
(209) 227-4341

If you don't have
time to do it
right the first time,
where will you find
time to fix the
mistakes you made!!

The sooner you start to code
The longer it will take.

Introduction

In the summer of 1982 I had the tremendously rewarding opportunity of teaching educational software design to five classes of educators on both east and west coasts. Although the courses were originally planned with a prerequisite of at least intermediate programming skill, I discovered, to my surprise, that most of the course registrants had little or no knowledge of a programming language. In fact, many of them had little exposure to computers!

Also to my surprise, however, at the end of all the three-week sessions, from more than 75 students I came away with 20 excellent program designs, designs I will be proud to produce in the coming months.

The secret of my students' success is not really a secret. Any experienced classroom teacher who knows his or her subject and who knows kids should be able to design a short program for a personal computer. A good program design depends upon the perspective of the designer. If the designer approaches the experience from the user's point of view without regard to limitations which may be imposed by hardware or programmer, a good design is almost always possible. By using the proper working tools, you can give an idea to a high-school student, to a college student, or even to a 6th grade student for coding and he or she can prepare a running version as you visualized it.

The rest of this chapter describes the tools which allow you, the educator, to communicate program ideas to yourself--or for others--to code. (To illustrate this process, you will find a complete educational program, SPELL-N-TIME, in the Appendix.)

The six steps

Designing programs to be used as instructional media tools in the classroom is a planning and writing of educational curriculum combined with techniques used in TV and movies. The six steps which I'll discuss in detail are:

-Statement of the problem.

-Writing objectives.

-Creating a storyboard.

-Writing pseudocode.

-Manual walkthrough.

-Coding and documentation.

(Scan the program in the Appendix. Can you recognize any of the above steps?)

Statement of the problem

Too often, the first thing we do when we get an idea is to sit down at our computer and start typing. But fuzzy goals yield fuzzy results and waste much time by forcing many revisions of our plans as we go along. Please refresh your memory right now by re-reading the "proverbs' at the beginning of this paper.

Stating a problem involves looking at a problem your students have, not a problem you, the teacher, have. For example, suppose your students are having a problem remembering how to spell certain words. That means you are not reaching them with a traditional methods. How can a new method, using the computer, be designed?

A statement of the problem, then, might be, "Traditional methods used in the time available do not seem to motivate my students or to permit them enough time-on-task to master spelling skills for their current vocabulary".

Notice that the problem statement tells you what to expect as an outcome to a successful solution: Your students will have time enough time-on-task to master spelling skills for their current vocabulary.

You need to understand the problem as your students encounter it. Observe how they succeed, how they fail. Begin to think about the ideal solution for the student. As Polya noted in his classic, How to Solve It, "Think on the end before you begin (3)."

Next, we develop specific objectives for our instructions to the computer. What exactly you do want to happen, at what time in the program, so your students will achieve mastery of the spelling skills?

Writing Objectives

Your first concern is to make certain that you take advantage of what a computer can do more effectively than the printed word. You will take pains not to program what Johnny and Sally can do more efficiently with pencil and paper or with a book.

In short, just becuase you can write a computer program to help a student learn does not mean that you should write it. To design and write a first-rate, well-documented short program will take you over 40 hours if you are quite skilled. Be certain your program has high odds that it will be superior to what can be done with pencil and paper or any other traditional medium.

You should focus your efforts at program design on those tasks, those ideas, which use the following, and other peculiar talents of the computer:

> Ability to adjust in milliseconds to the rate of learning of the student, whether slow or fast.
>
> Ability to motivate through instant feedback, timing, scoring, color graphics, sound and animation.
>
> Ability to sum up the student's performance and needs in seconds without need to distract you from other more important duties of one-to-one teaching.
>
> Ability to show graphically the pattern of the student's errors, to compute the level of mastery of task and to estimate the time the student requires to achieve mastery.
>
> Ability to aid in diagnosis and to reduce the drudgery of the clerical tasks of paperwork and record-keeping.

We expect the objectives of the spelling program we are designing to reflect these computer abilities. We might select features to make our program more effective such as:

a. Flash words at varying speed based on word length and accuracy of the student so as to increase chances of success for the slow learner or to challenge the capacity of the gifted.

b. Second try -- flash syllables instead of the whole word. Research indicates this helps spelling skills.

c. Third try -- display the word on the screen until it is correctly typed. Give the learner a feeling of "Hooray, I copied it right!" rather than "Phooey! I failed to spell it right."

d. Compute a score based on time and accuracy -- like an educational pinball machine.

e. Report the number of words correct as well as score.

f. Display the list of mis-spelled words at end of game.

g. Enable the teacher to change the words for today's vocabulary, even to Spanish or French.

h. Give the teacher control over how many words are presented in a game.

These objectives do not by any means exhaust the capabilities of the computer. My purpose here is, of course, to demonstrate what you can do with a short program.

For example, other special skills of the computer enable you to achieve user-friendly advantages such as these:

Give the student control of movement forward or backward in a step-by-step development.

Simulate difficult, time-consuming, or dangerous events such as the Three-Mile Island nuclear accident.

Armed with your objectives, you need to determine a plan to solve the student's problem with mastery of spelling. That brings us to the storyboard technique. (Where in the documentation in the Appendix do you find the objectives?)

Creating a Storyboard

Assume you have defined your objectives with clarity. Then you must detail the step-by-step sequence to work toward each objective from the teaching point of view: Exactly what will the user experience?

Most methods or procedures for designing programs appear weakest at this point.

A technique used for decades in the movie, animation and TV industries is the storyboard. It is a simple technique to show graphically what is to occur, frame by frame for film, or second by second for the computer. This is how it works in film:

> Tack a set of 3x5 cards (or equivalent) to a bulletin board (Figure 1).
>
> Sketch on each card a 'scene' which indicates whether the scene is a long shot, medium shot, closeup, or extreme closeup.
>
> Write on each card a description of the action in that scene.
>
> Change the scene sequence, if desired, by moving cards about on the backing as you plan the project.

Cards may be altered, removed or replaced to reflect changes in sequence or decisions on scenes.

This technique fits easily into the task of planning a computer lesson or a program. Rather than 3x5 cards, you should use graph paper. Select paper with the same width as the number of characters per line and the same height as the number of lines on the computer screen. The result should be a layout which is carefully spaced to show how the material is to appear on the screen (Figure 2).

When a number of messages appear on the same background, or 'board,' overlays can be made. (Figures 3-7).

A conclusion to the 'game' appears in Figures 8 and 9.

FIGURE 1

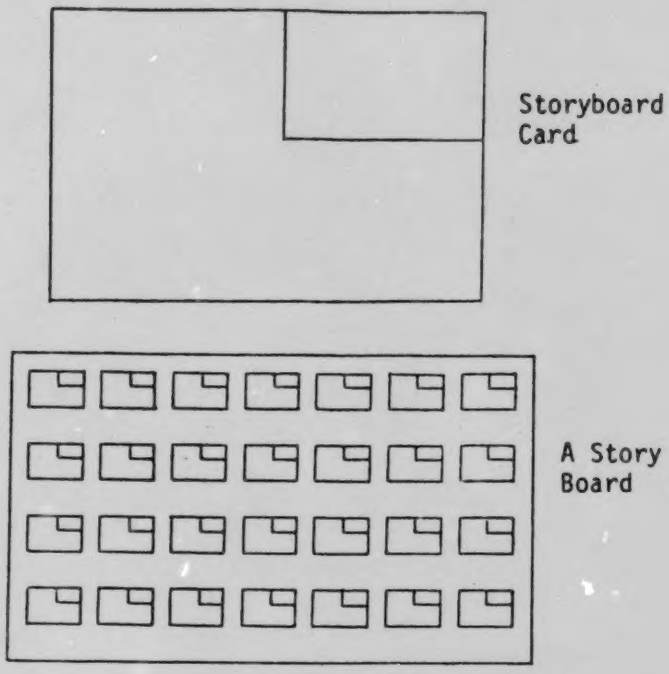
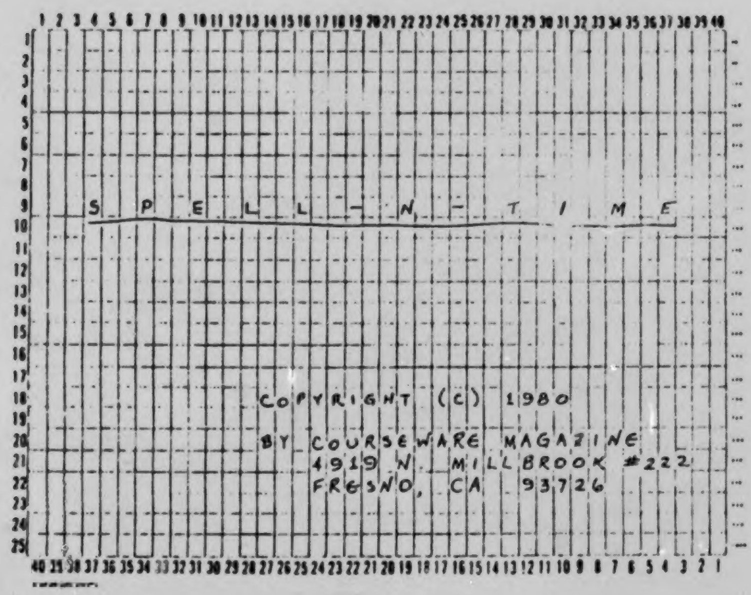

Storyboard
Card
A Story
Board

FIGURE 2



SPELL-N-TIME

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BY COURSEWARE MAGAZINE
4919 N. MILLBROOK #222
FRESNO, CA 93726

BEST COPY AVAILABLE

FIGURE 3

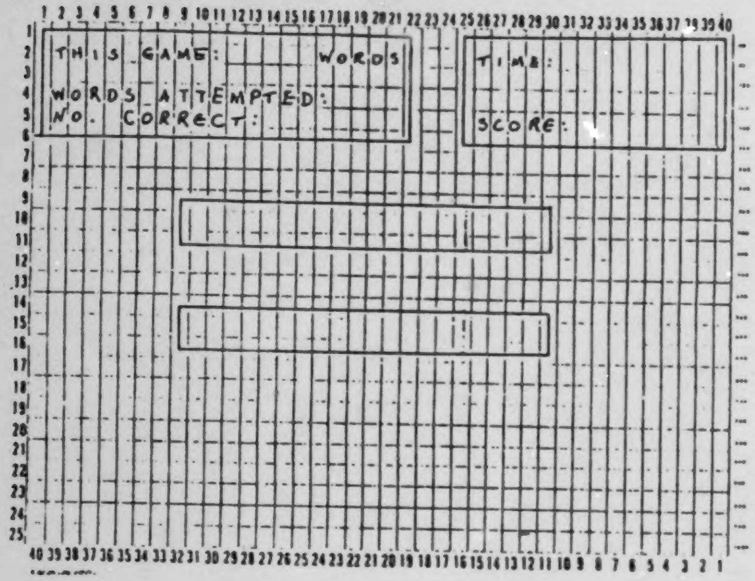

THIS GAME: WORDS
WORDS ATTEMPTED:
NO. CORRECT:
TIME:
SCORE:

FIGURE 4

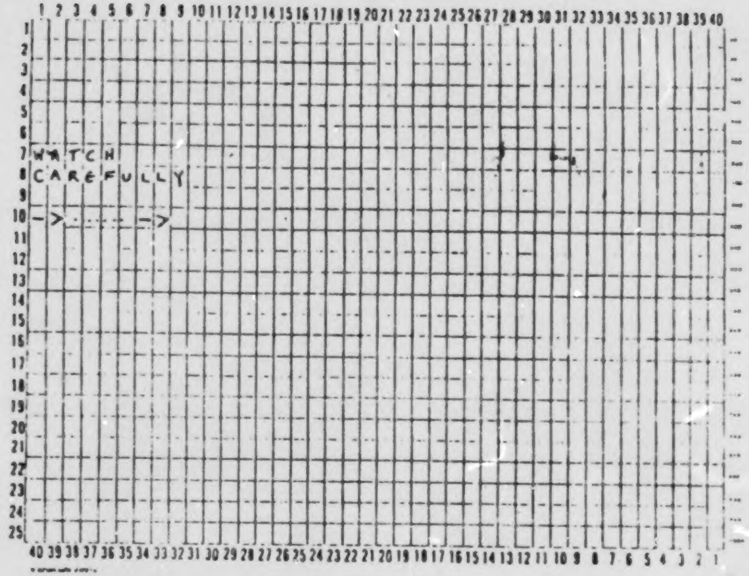

WATCH
CAREFULLY
->.......->

FIGURE 5

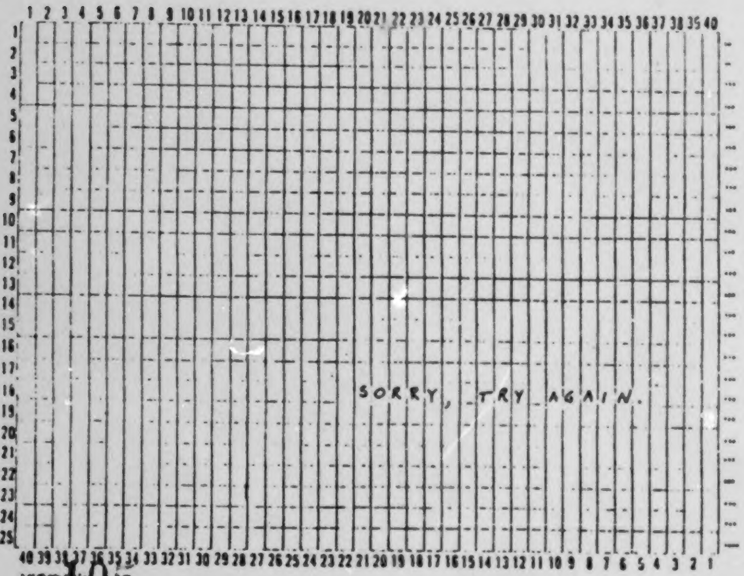

SORRY, TRY AGAIN.

FIGURE 6

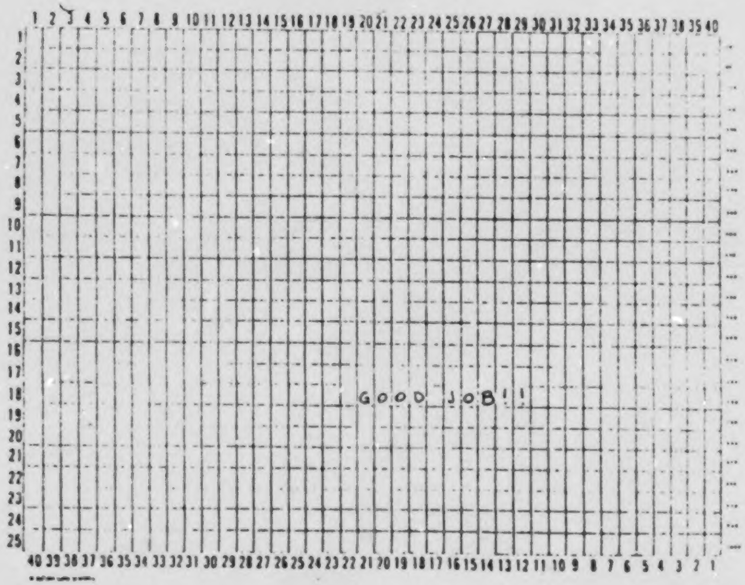
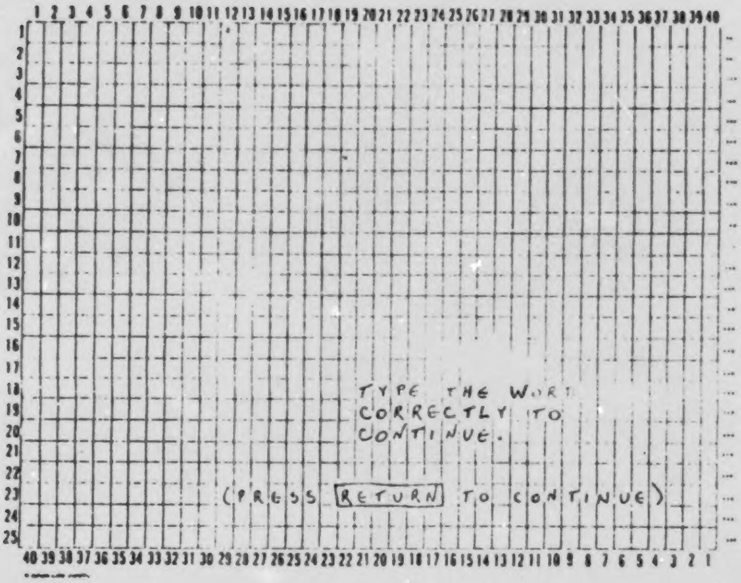

GOOD JOB!!

FIGURE 7

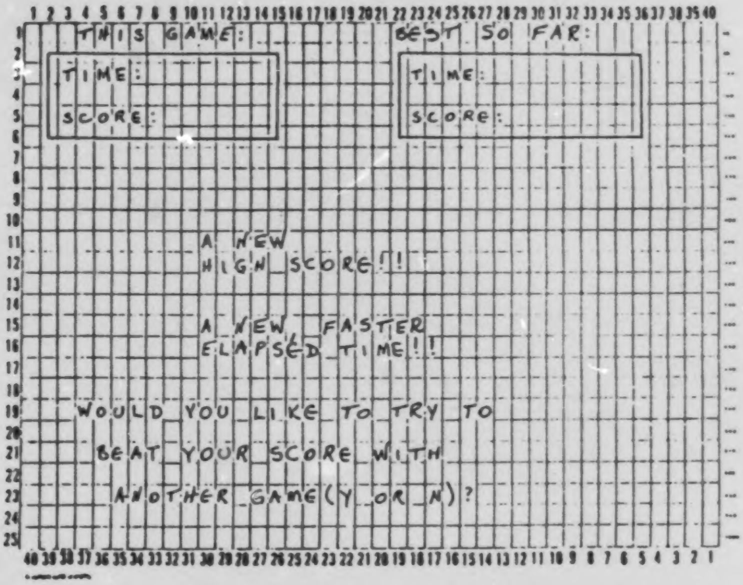

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

TYPE THE WORD
CORRECTLY TO
CONTINUE.

(PRESS RETURN TO CONTINUE)

BEST COPY AVAILABLE

FIGURE 8



THIS GAME:

TIME:

SCORE:

BEST SO FAR:

TIME:

SCORE:

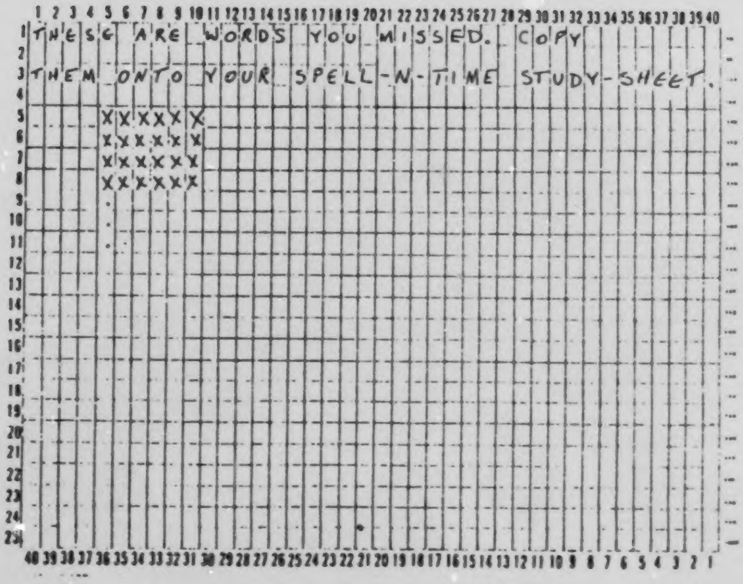
A NEW
HIGH SCORE!!

A NEW, FASTER
ELAPSED TIME!!

WOULD YOU LIKE TO TRY TO
BEAT YOUR SCORE WITH
ANOTHER GAME(Y OR N)?

Figure 8

FIGURE 9



THESE ARE WORDS YOU MISSED. COPY
THEM ONTO YOUR SPELL-N-TIME STUDY-SHEET.

XXXXXX
XXXXXX
XXXXXX
XXXXXX

Figure 9

BEST COPY AVAILABLE

With the storyboard created you should test each objective while viewing the storyboard as if the program actually were on screen. You can discover incorrect logic or see where the student-machine interaction can be refined. With this type of preparation you should seldom be surprised by a strange screen display. At this stage you can easily add missing experiences. Once the program is written, additions are messy.

Satisfied with the storyboard, you can turn to writing a plain English statement of the program, the 'pseudocode'. (Where in the documentation in the Appendix do you find the storyboard or evidence one was prepared?)

Writing the pseudocode

As program designer, you have given the 'frames' in the storyboard a passing grade and you turn to laying out the logic of the program in 'pseudocode'. Pseudocode is written in simple English logic. It is not a programming language or code such as BASIC code, COBOL code or FORTRAN code. The pseudocode stage is important since it is a logically clear statement and easy to translate into a target computer language.

Start writing the pseudocode with a statement of the problem. Refine that statement repeatedly until no more refinement is needed. The major logic steps of our problem are:

```
a. print title page.
b. play the game.
c. display the mis-spelled words.
d. Conclusion — comparison of this game with the best
   score attained previously.
```

Compare the final pseudocode logic in the appendix with the storyboards above. How does the pseudocode relate to the story board?

You do not need to follow every step of the pseudocode logic. We have not described each program detail. But notice the use of indentations and underlining of IF, THEN, ELSE and WHILE words.

Take the first module, SET START TIME. It is a logical whole. It requires several, or many, steps in any given programming language but it can be grasped easily by the reader. If you were studying a program coded in a specific computer language, often you would be asking questions like, 'What are these five lines doing?'

Manual walkthrough

You still haven't written a single line of code. But if you continually debug your logic as you go along, there should be few, if any, bugs in your final coding.

Before the coding step, once again you should 'walk through' the pseudocode, testing every possible branch and concept. You check to verify that each module will do logically what it was designed to do. Then, and only then, should you start coding.

Coding and documentation

Select your programming language, arm yourself with paper and pencil, and prepare to code your program based on your pseudocode logic. Coding with paper and pencil will lead to fewer errors and less wasted time than coding at the keyboard. You should code each logic module separately from every other module. And you should use modular, structured, top down, one-way-in, one-way-out programming style (explaining those concepts takes another paper*).

---

*Send $4.00 (includes shipping and handling) for "What is Top-Down, Structured, Modular, One-way-in, One-way-out, Programming style" to School & Home CourseWare, Inc., 13[illegible] Bulldog Lane, Suite C, Fresno, CA 93710.

Proper documentation inside the program code as you write it must include (see coding example, in Appendix):

- many, many REMarks.
- 'paragraphing' with spaces, horizontal lines and paragraph headings for each module and subroutine.

External documentation of an educational computer program should include (p. 3, Appendix):

- computer languages available for the program.
- subject area covered.
- grade level.
- an abstract of the program.
- basic instructional use.
- how the teacher can personalize the program for his/her classroom (appendix, p. 4).
- pseudocode (appendix, p. 6).
- description of variables (appendix, p. 9)
- an index of subroutines used (appendix, p. 10)
- a complete program listing.
- a student guide with student objectives and student worksheet or record sheet (appendix, pp. 17-18).

Summary

You will note that this chapter did not specify a computer language, e.g., BASIC, PASCAL, etc. How you design an educational computer program is independent of the language you use. This is essential if the final program is to be understood by anyone except the program's author.

A program can be used only as an instructional media tool or it can be given additional use as a model to teach programming. As an instructional media tool, it must adapt to the needs of a teacher who usually is a non-programmer. As a model and a tool to teach programming, it should be an example of clarity and readability. We use Shakespeare to teach English, why do less to teach programming?

Suggested reading

(1) Goodman, S. E., and Hedetniemi, S. T. Introduction to the Design and Analysis of Algorithms. New York: McGraw Hill Book Company, 1977. pp. 18-35.

(2) Nevison, John M. The Little Book of BASIC style: How You Can Write a Program You Can Read. Reading, MA: Addison-Wesley Publishing Company, 1978.

(3) Polya, G., How to Solve It. Doubleday Anchor Books, Garden City, N.Y. 1957.

(4) Schneider, G. Michael, Weingart, Stephen W., and Perlman, David M. An Introduction to Programming and Problem Solving with PASCAL. New York: John Wiley and Sonce, 1978.

APPENDIX

SPELL-N-TIME

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Computer languages available: Applesoft BASIC 16K
PET BASIC 8K
TRS-80 Level 2 BASIC 16K

Subject areas: All

Grade levels: All

Objectives: After spelling practice with a computer-presented, randomly-selected subset of a set of words chosen by the teacher, the student's computer score will increase and the student's time to complete a spelling exercise will decrease. (Student score is based on spelling accuracy and time.)

Abstract: The computer flashes a whole word; the student must type the correctly spelled word. A second chance is given for incorrect responses, but this time the syllables of the word are flashed in sequence (if more than one syllable). After a second incorrect response, the word is retained on the screen and the student must type it correctly before the game will continue. Score is based on time and accuracy.

Presentation-time of words varies depending upon the ability of the user: a series of incorrect responses will cause slower presentation-time, a series of correct responses will cause faster presentation-time. At the end of each game, a list of mis-spelled words will appear on the screen for the student to write on his/her worksheet.

Basic instruction use: This program is designed as a fun drill in spelling words and in sight recognition of words. It can be used to advantage in any curriculum area where sight recognition and spelling is considered important.

The teacher has control of the vocabulary used and may change or update the vocabulary list daily. The teacher also controls the number of words to be presented to the student during each "game."

Many teachers will create a separate tape for each day's lesson with only the new words for that lesson in the vocabulary list. Spanish or French students (for example) who were absent from a class drill might use the computer review to catch up on what they missed.

Why use the SPELL-N-TIME program? SPELL-N-TIME is a dynamic experience which allows all students to be successful, it makes full use of the computer's unusual talents. Because presentation-time of words in the program is dependent on student skill, weak students are allowed more time to recognize and spell a word, while stronger students are given less time. This permits weaker students to feel success a high percentage of the time because they are correctly spelling words even though their score may be held down because of slower achievement times.

Immediate feedback and high percentage of success is a great motivator--nothing succeeds like success. Neither flash cards nor worksheets have this ability to motivate. You, as teacher, can motivate by personal, one-to-one attention, but you haven't the time, the patience, or the ability to adjust and to keep score that your personal microcomputer has.

How to select the number of words presented in each game: Line 173 (variable: NW) determines the number of words the student will be exposed to in each game. You may change this line by typing:

```
173 NW = 25
```

if you wish 25 words to be presented in each game, or:

```
173 NW = 32
```

if you wish 32 words to be presented.

Line 173 may be changed by the teacher or user after the program is loaded, or may be changed and the altered program saved on a different tape. (You might title the new program SPELL-N-TIME-32 if NW=32.)

How to insert a teacher-chosen vocabulary: Lines 174 through 198 are reservedd for DATA words. You should have at least as many words on those lines as variable NW is set to on line 173. As written, the program will allow for a maximum of 50 words (DIM R$(50)). To store more words (if the size of your computer's memory will allow), change line 167 to:

```
167 DIM R$(60)
```

or

```
167 DIM R$(100)
```

if you wish to store 60 (or 100) words.

The sample data words are from <u>Spell Correctly</u>, Edition 5, Silver Burdett, 1974. To remove the sample DATA words in preparation for entering your own vocabulary, erase each existing DATA line by typing a line number follwed by a RETURN (or ENTER), thus:

```
174↓      ( ↓ means RETURN)
175↓
176↓
   etc.
```

Here is a sample vocabulary being added. Type a line number, followed by the word DATA, followed by your DATA words (with a hyphen between each syllable) separated by commas (no comma at the end of a line, though). Put no spaces after commas between words. Thus:

```
174 DATA dy-nam-ic,ex-per-i-ence,al-lows,all,stu-dents,suc-ce
ss-ful,da-ta
175 DATA be-cause,pre-sen-ta-tion
```

and so on.

A PET DATA line may be up to 80 characters long (two screen lines). A TRS-80 DATA line may be up to 241 characters long (i.e. about 3 2/3 screen lines), while an Apple II DATA line may be up to 239 characters long.

<u>How to open binder to remove pages for copying</u>: The white, plastic spine may be opened for easy paper removal by simply pulling apart with the fingers. The spine snaps closed by squeezing.

(For PET owners only)
<u>How to fit a 9.2K program into an 8K PET</u>:

You'll notice that the number of bytes used in the program listing is 9231. How can that program possibly fit in an 8K machine?

After writing, entering, running and debugging the completely documented program, we removed every non-essential REM line and REMark. That way, if you need to make changes to the program, your line numbers will be the same as in the listed program. The actual, running program length is about 7K--and therefore fits nicely in an 8K machine.

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Procedure

```
1.0 Introduction and Title Page.

2.0 LOOP

   2.1 Initialize all constants and read vocabulary words into
       array R$.

   2.2 Draw 4 windows and display number of words in game. Press
       RETURN.

   2.3 For words attempted (WA) = 1 to number of words per game (NW)

     2.3a  set start time (BG) and select a word (W$),

     2.3b  remove hyphens from data word and store in variable
           (FH$),

     2.3c  also store syllables in array (FW$(J)).

     2.3d  if first try (FL=0)

             then store FH$ also in F$,
                  display "watch carefully" and arrow,
                  flash word,
                  get response (GT$),
                  update time.

                  if response is correct

                    then   increase score (SC),
                           add 1 to number correct (NC),
                           print praise message,
                           add 1 to consecutive correct counter
                             (CCC),
                           set consecutive incorrect counter
                             (CIC) to zero,
                           update windows,
                           press return,
                           erase answer and message.

                    else   print sorry message,
                           add 1 to consecutive incorrect
                             counter (CIC),
                           set consecutive correct counter
                             (CCC) to zero,
                           set attempt flag = 1 (FL),
                           increment missed-word counter (I),
                           store missed word (MW$(I)),
                           erase answer and message.
```

```
2.3e  if second try (FL=1)
        then display "watch carefully" and arrow,
             flash syllables,
             get response (GT$),
             update time,

             if response is correct

                then   increase score,
                       print praise message,
                       update windows,
                       press RETURN,
                       erase answer and message.

                else   print "type the word correctly to
                         continue."
                       set attempt flag = 2 (FL).

2.3f  if third try (FL=2)

        then display word (do not erase),
             get response,
             while response is incorrect
                       press return,
                       erase answer and message,
                       get response.
             increase score,
             update windows,
             press RETURN,
             erase flash window,
             erase answer and message.

2.3g  if word was answered correctly on first try (FL=0)

        then swap word used with last word in array,
             decrement number-of-words counter (N).

2.4 Compute elapsed time for game.

2.5 List words missed. Press RETURN.
```

```
  2.6 Print a frame with time and score comparison to best so far.
    2.6a if score is better than best so far
          then  flash "A new high score!!"
                save new high (BS).
    2.6b if time is better than best so far
          then  flash "A new, faster elapsed time!!"
                save new elapsed time (BT).
  2.7 Query if user wants to try another game.
3.0 END
```

Description of Variables

AW$	cursor to answer window
BG	start time of game
BS	best score so far
BT	best time so far
CIC	consecutive incorrect counter
CCC	consecutive incorrect counter
C1-C4	save cursor location
ER$	erase 20 spaces
ET	elapsed time of game
FH$	flash word without hyphens
FL	attempt flag
FT	flash time
FW$	cursor to flash window
FW$()	syllables of word
GT$	response
I	missed-word index counter
LP	left pointer
MW$()	missed words
N	number of words in data list
NC	number correct
NC$	cursor to number correct
NW	number of words per game
P5	pause in seconds
PR$	cursor to press-return phrase
PW$	cursor to praise window
R	random number
R$()	random-word array
RP	right pointer
RW	random-word pointer
R9$	cursor 9 right
SC	score
SC$	cursor to score
T$	temporary storage
TI	internal timer in 60ths
TS	start time
TW$	cursor to timer window
W$	randomly selected word
WA	words attempted
WA$	cursor to words-attempted
WCW$	cursor to word-count window

Subroutine Index

7100	update scoring windows
7200	flash words and syllables
7400	erase answer and message windows
7600	compute flash time
7800	watch carefully
8200	pause
8400	'get'
8600	timer
9000	press RETURN

114

```
************************************************************
***      SPELL-N-TIME                                      **
                                        BYTES: 9231
                                        DATE:  9/17/80
                                        TIME:  19.08
************************************************************

100 REM "SPELL-N-TIME"
105 POKE 59468,12 :REM GRAPHICS MODE
110 PT=PEEK(50003)
120 REM ================================
122 REM        T I T L E   P A G E
124 REM ================================
130 PRINT "▮▮▮▮▮▮▮▮▮▮"
135 PRINT TAB(3);"S   P   E   L   L   -   N   -   T   I   M   E"
140 PRINT TAB(3);"____________________________________________"
145 PRINT "▮▮▮▮▮▮▮▮";TAB(14);"COPYRIGHT (C) 1980▮"
150 PRINT TAB(14);"BY COURSEWARE MAGAZINE"
155 PRINT TAB(17);"4919 N. MILLBROOK #222"
160 PRINT TAB(17);"FRESNO, CA  93726"
165 P5=4: GOSUB 8200 :REM PAUSE
167 DIM R$(50)
170 REM ================================
171 REM  WORDS PER GAME & DATA WORDS
172 REM ================================
173 NW=10 :REM # OF WORDS PER GAME
174 DATA A-BAN-DON,AC-CI-DENT,AC-CUS-TOMED,AD-DI-TION,AD-DRESS,AIL-MENT
175 DATA AL-TI-TUDE,A-MER-I-CAN,AP-PLAUD,A-PRON,AT-MOS-PHERE,AUNT,AU-TO-MAT-
176 DATA AU-TUMN,AV-E-NUE,AV-ER-AGE,AXLE,BA-CON,BAG-GAGE,BALD,BA-NAN-A,BAND
177 DATA BAN-NER,BARE,BARGE,BAR-REN,BASE-MENT,BASS,BAT-TLE,BEACH
178 DATA BEAST,BEAU-TY,BEEF,BE-GIN-NING,BE-HAVE,BE-LIEVE,BELT,BI-CY-CLE
179 DATA BLAN-KET
199 DATA "NO MORE WORDS"
200 REM ================================
202 REM           INITIALIZE
204 REM ================================
205 RESTORE
210 R9$="▮▮▮▮▮▮▮▮▮▮"
215 ER$="                         "
220 WCW$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
225 TW$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
230 FW$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
235 AW$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
240 PR$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮(PRESS ▮RETURN▮ TO CONTINUE)
245 PW$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
250 WA$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
255 NC$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
260 SC$="▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮"
265 R=RND(-TI)
275 SC=0 :I=0
277 WA=0 :NC=0
280 C1=224-PT*28:C2=225-PT*28:C3=226-PT*28:C4=245-PT*29
282 :
284 REM  READ VOCAB. WDS INTO ARRAY R$
286 K=1
288 :
290 READ R$(K)
292 IF R$(K)="NO MORE WORDS" THEN N=K-1 :GO TO 300
294 K=K+1
296 GO TO 290
```

```
298 :
300 REM ==============================
302 REM          DRAW 4 WINDOWS
304 REM ==============================
310 PRINT "⌝┌────────────────────┐  ┌────────────┐"
315 PRINT  "│THIS GAME:    WORDS│  │TIME:       │"
320 PRINT  "│                   │  │            │"
325 PRINT  "│WORDS ATTEMPTED:   │  │            │"
330 PRINT  "│NO. CORRECT:       │  │SCORE:      │"
335 PRINT  "└───────────────────┘  └────────────┘▓▓"
340 PRINT R9$;" ┌────────────────────┐"
345 PRINT R9$;"│                    │"
350 PRINT R9$;"└────────────────────┘▓▓"
355 :
360 PRINT R9$;"┌────────────────────┐"
365 PRINT R9$;"│                    │"
370 PRINT R9$;"└────────────────────┘"
410 IF N<NW THEN NW=N :REM FEWER THAN NW DATA WORDS.
415 PRINT WCW$;NW  :REM TO WORD COUNT WNDOW
430 PRINT TW$;00
435 GOSUB 7100 :REM UPDATE SCORING WNDW
485 GOSUB 9000 :REM PRESS RETURN
500 REM ==============================
502 REM      SELECT AND FLASH WORDS
504 REM ==============================
507 BG=TI :REM SET BEGIN TIME FOR GAME
510 FOR WA= 1 TO NW
515 R = INT(N*RND(1))+1
520 W$=R$(R) :REM SELECT A WORD
525 FL=0     :REM 'ATTEMPT' FLAG
530 :
535 IF FL<>0 THEN 720
540 REM ==============================
545 REM  REMOVE HYPHENS FROM DATA WORD
547 REM ==============================
550 FH$="" :J=1
555 LP=1 :REM  LEFT POINTER
560 FOR RP=1 TO LEN(W$)
565 IF MID$(W$,RP,1)<>"-" THEN 570
567 FW$(J)=MID$(W$,LP,RP-LP)
568 FH$=FH$+FW$(J)
569 LP=RP+1 :J=J+1
570 NEXT RP
573 FW$(J)=MID$(W$,LP,LEN(W$)+1-LP) :REM ATTACH LAST SYLLABLE
574 FH$=FH$+FW$(J)
580 REM ==============================
582 REM           FIRST TRY
584 REM ==============================
600 F$=FH$
602 GOSUB 7800 :REM 'WATCH CAREFULLY'
605 GOSUB 7200 :REM FLASH WORD
610 GOSUB 8400 :REM GET RESPONSE & UPDATE TIME
625 :
640 IF GT$<>FH$ THEN 680
642 SC=SC + INT(800*360/(TI-TS))
643 NC=NC+1 :REM ADD 1 TO # CORRECT
645 PRINT PW$;"GOOD JOB!!" :REM RIGHT
650 CCC=CCC+1 :REM CONSEC. CORRECT CTR.
655 CIC=0 :REM CONSEC. INCORRECT CTR.
```

```
657 GOSUB 7100 :REM UPDATE WINDOWS
660 GOSUB 9000
665 GOSUB 7400 :REM ERASE ANS & MESSG
670 GO TO 900
675 :
680 PRINT PW$;"SORRY, TRY AGAIN." :REM WRONG
685 CIC=CIC+1
690 CCC=0
695 FL=1
697 I=I+1
700 MW$(I)=FH$ :REM STORE MISSED WORD
705 GOSUB 9000
710 GOSUB 7400
712 REM ===============================
715 REM             SECOND TRY
717 REM ===============================
720 IF FL<>1 THEN 820
725 GOSUB 7800 :REM 'WATCH CAREFULLY'
730 FOR K=1 TO J :REM  FLASH SYLLABLES
735 F$=FW$(K) :GOSUB 7200
737 P5=.05 :GOSUB 8200
740 NEXT K
745 :
750 PRINT AW$;TAB(INT(20-LEN(FH$)/2));
755 GOSUB 8400
760 IF GT$<>FH$ THEN 875
765 SC=SC+INT(600*360/(TI-TS))
770 PRINT PW$;"THAT'S IT!!"
772 GOSUB 7100 :REM UPDATE WINDOWS
775 GOSUB 9000
780 GOSUB 7400
785 GO TO 900
790 :
800 PRINT PW$;"TYPE THE WORD"
805 PRINT PW$;"█CORRECTLY TO"
807 PRINT PW$; "██CONTINUE."
810 FL=2
812 REM ===============================
813 REM             THIRD TRY
815 REM ===============================
820 IF FL<2 THEN 900
825 PRINT FW$;TAB(INT(20-LEN(FH$)/2));FH$
830 PRINT AW$;TAB(INT(20-LEN(FH$)/2));
835 GOSUB 8400
840 :
845 IF GT$<>FH$ THEN 875
850 SC=SC+300
852 GOSUB 7100 :REM UPDATE WINDOWS
855 GOSUB 9000
857 PRINT FW$;ER$
860 GOSUB 7400
865 GO TO 900
870 :
875 GOSUB 9000
880 GOSUB 7400
885 GO TO 800 :REM WAIT FOR CORRECT RESPONSE
900 REM ===============================
902 REM             HOUSEKEEPING
904 REM ===============================
907 IF FL<>0 THEN 960 :REM DON'T SWAP IF WORD WAS MISSED.
915 :    REM SWAP USED WORD WITH 'LAST' WORD IN RANDOM ARRAY
920 T$=R$(R)
925 R$(R)=R$(N)
930 R$(N)=T$
935 N=N-1
940 :
960 NEXT WA
970 ET=INT((TI-BG)/60) :REM ELAPSED TIME FOR GAME
1000 REM ===============================
1002 REM         LIST WORDS MISSED
1004 REM ===============================
1010 IF I=0 THEN 1100 :REM NO ERRORS
1015 PRINT "]THESE ARE WORDS YOU MISSED. COPY▩"
1020 PRINT "THEM ONTO YOUR SPELL-N-TIME STUDY-SHEET."
1025 FOR K=1 TO I
1030 PRINT TAB(5);"▓";MW$(K)
1035 NEXT K
1040 GOSUB 9000
1100 REM ===============================
1102 REM      TIME-SCORE COMPARISON
1104 REM ===============================
1110 PRINT "]   THIS GAME:";TAB(22);"BEST SO FAR:"
1115 PRINT "  ┌────────────┐";TAB(22);"┌─────────────┐"
1120 PRINT "  |TIME: ";ET;TAB(15);"|";TAB(22);"|TIME: ";BT;TAB(36);"|"
1125 PRINT "  |            |";TAB(22);"|             |"
1130 PRINT "  |SCORE:";SC;TAB(15);"|";TAB(22);"|SCORE:";BS;TAB(36);"|"
1135 PRINT "  └────────────┘";TAB(22);"└─────────────┘▩▩"
1137 :
1139 IF BS=0 THEN 1170
1140 IF SC<=BS THEN 1173
1142 FOR ZK = 1 TO 20
1145 IF ZK/2 = INT(ZK/2) THEN 1162
1155 PRINT FW$;"▓A NEW"
1160 PRINT TAB(11);"▓HIGH SCORE!!"
1161 GO TO 1165
1162 PRINT FW$;"A NEW"
1163 PRINT TAB(11);"HIGH SCORE!!"
1165 NEXT ZK
1170 BS=SC :REM SAVE NEW HIGH
1172 :
1173 IF BT=0 THEN 1200
1174 IF ET>=BT THEN 1210
1176 FOR ZK = 1 TO 20
1178 IF ZK/2 = INT(ZK/2) THEN 1186
1180 PRINT AW$;TAB(14);"▓A NEW, FASTER"
1182 PRINT TAB(18);"▓ELAPSED TIME!!"
1184 GO TO 1195
1186 PRINT AW$;TAB(14);"A NEW, FASTER"
1188 PRINT TAB(18);"ELAPSED TIME!!"
1195 NEXT ZK
1200 BT=ET :REM SAVE NEW TIME
1205 :
1210 PRINT "▩▩  WOULD YOU LIKE TO TRY TO"
1215 PRINT "▩      BEAT YOUR SCORE WITH "
1220 PRINT "▩        ANOTHER GAME (Y OR N)?"
1225 GET Q$ :IF Q$="" THEN 1225
1230 IF Q$="Y" THEN 200
1235 IF Q$<>"N" THEN 1225
```

```
1290 PRINT "▓END OF PROGRAM. TYPE ▒RUN▄ TO START AGAIN"
1500 END
7100 REM ==============================
7102 REM   SUBR - UPDATE SCORING
7103 REM                WINDOWS
7104 REM ==============================
7110 PRINT WA$;WA
7115 PRINT NC$;NC
7120 PRINT SC$;SC
7130 RETURN
7200 REM ==============================
7202 REM   SUBR - FLASH WORDS & SYLL
7204 REM ==============================
7215 GOSUB 7600 :REM 'CMPUTE FLASH TM'
7220 PRINT FW$;TAB(INT(20-LEN(F$)/2));F$ :REM  CENTER WORD AND DISPLAY IT.
7225 TS=TI
7230 IF TI-TS < FT*60 THEN 7230 :REM FLASH TIME.
7235 PRINT FW$;ER$ :REM ERASE WORD
7240 :
7245 PRINT AW$;TAB(INT(20-LEN(FH$)/2));
7255 RETURN
7400 REM ==============================
7402 REM   SUBR - ERASE ANS & MESSG
7404 REM ==============================
7410 PRINT AW$;ER$
7415 PRINT PW$;ER$
7420 FOR ZK=1 TO 3
7425 PRINT TAB(19);ER$
7430 NEXT ZK
7435 RETURN
7600 REM ==============================
7602 REM   SUBR - COMPUTE FLASH TIME
7604 REM ==============================
7610 FT=.05*LEN(F$)
7615 IF CCC>2 THEN FT=FT-(CCC-3)*.1
7620 IF CIC>2 THEN FT=FT+(CIC-3)*.1
7625 RETURN
7800 REM ==============================
7802 REM     SUBR - WATCH CAREFULLY
7804 REM ==============================
7805 PRINT TW$;"    "
7810 PRINT "▚▩▩▩▩▩▩WATCH"
7815 PRINT "CAREFULLY▩"
7820 FOR ZK = 1 TO 7
7825 PRINT " ->▮▪▮"; :P5=.1 :GOSUB 8200
7830 NEXT ZK
7832 PRINT "▚▩▩▩▩▩▩";
7833 FOR ZK=1 TO 4 :PRINT "              " :NEXT :REM  ERASE.
7835 RETURN
8200 REM ==============================
8202 REM          SUBR - PAUSE
8204 REM ==============================
8210 FOR K6=1 TO 700*P5:NEXT K6
8215 RETURN
8400 REM ==============================
8402 REM          SUBR - 'GET'
8404 REM ==============================
8413 POKE 525-PT*367,0 :REM CLEAR INPUT BUFFER.
8415 GT$=""
```

```
 8417 T5=TI :T4=1
 8420 GET Q$ :IF Q$<>"" THEN 8510
 8422 IF T5<=TI THEN PRINT MID$("▚ ▀ ▌ ",T4,3);"▌"; :T4=5-T4 :T5=TI+15
 8430 GOSUB 8600 :REM UPDATE THE TIMER
 8485 GO TO 8560
 8490 :
 8510 IF Q$=CHR$(13) THEN PRINT " ▌" :RETURN
 8515 IF Q$<>CHR$(20) THEN 8545 :REM  DELETE KEY.
 8520 PRINT "▌ ▌▀▌";
 8525 IF LEN(GT$)<=1 THEN GT$="" :REM  DELETE FROM STORED WORD.
 8530 IF LEN(GT$)>1 THEN GT$=LEFT$(GT$,LEN(GT$)-1)
 8535 GO TO 8560
 8540 :
 8545 GT$ = GT$+Q$ :REM CONCATENATE NEW LETTER TO WORD.
 8550 PRINT Q$;
 8560 GO TO 8420
 8600 REM =============================
 8602 REM          SUBR - TIMER
 8604 REM =============================
 8610 TA=PEEK(C1):TB=PEEK(C2):TC=PEEK(C3):TD=PEEK(C4) :REM SAVE CRSR LOC.
 8620 PRINT TW$;INT((TI-TS)/60)
 8630 POKE C1,TA:POKE C2,TB:POKE C3,TC:POKE C4,TD :REM RESTORE CRSR LOC.
 8640 RETURN
 9000 REM =============================
 9002 REM       SUBR - PRESS RETURN
 9004 REM =============================
 9010 POKE 525-PT*367,0 :REM CLEAR KEYBOARD BUFFER.
 9015 PRINT PR$  :REM   PRESS RETURN
 9020 GET Q$ :IF Q$<>CHR$(13) THEN 9020
 9025 PRINT "┐                                        "
 9030 RETURN
63900 REM =============================
63902 REM      PRINTER INSTRUCTIONS
63904 REM =============================
63910 PP$ = "SPELL-N-TIME"
63990 INPUT "DATE";D$ :INPUT "TIME";T$
63991 PP$="**  "+PP$+"  **"
63992 OPEN4,4 :OPEN8,4,3 :PRINT#8,59 :T=80-3*LEN(PP$)
63993 PRINT#4,TAB(T); :FORK=1 TO (80-T) :PRINT#4,"*"; :NEXT
63994 PRINT#4,TAB(T)CHR$(1)CHR$(1)CHR$(147)PP$
63995 PRINT#4,TAB(60)"BYTES:"15359-FRE(0)
63996 PRINT#4,TAB(60);"DATE:  "D$ :PRINT#4,TAB(60);"TIME:  "T$
63998 PRINT#4,TAB(T); :FORK=1TO(80-T) :PRINT#4,"*"; :NEXT :CMD4 :LIST
READY.
```

SPELL-N-TIME

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CourseWare Magazine

Computer languages available: Applesoft BASIC 16K
PET BASIC 8K
TRS-80 Level 2 BASIC 16K

Subject areas: All

Grade levels: All

Abstract: The computer will flash a word, you are to type the word correctly spelled. If you mis-spell the given word, it will be flashed once more in syllables (if more than one syllable). If your second response is incorrect, the word will be held on the screen until you type it correctly.

Your score is based on speed and accuracy.

Objective: To improve your ability to recognize and spell words. Your score should improve as you play more games.

Use of your worksheet: At the end of each game, the words you are not sure of will be listed on the screen. Copy these words onto your worksheet so you can keep track of your progress, share your progress with your teacher, and practice words you are not comfortable with.

Study sheet

Student ____________________

Date __________ Class ________

LIST OF WORDS MIS-SPELLED OR INCORRECTLY RECOGNIZED

Game 1

Game 2

Game 3

Game 4

Game 5

Game 6

BEGINNING PROGRAMMING

by Bill Gulley

Purpose

This article describes types of programming languages, use and modification of software packages, and how educational users can learn more about programming.

Types of Computer Languages

The term software means "instructions for computers." It is a broad term and includes both general-purpose programming languages and software packages. To make matters more confusing, there are new hybrid forms. A general-purpose programming language can be used for a variety of tasks. A software package is a commercially-prepared program, written in a general-purpose language. For want of a better term, the new hybrid forms can be called user-oriented languages, since they are relatively simple to use and have been specifically designed for use by non-specialists.

General-Purpose Programming Languages

General-purpose programming languages can be divided into two broad groups: lower-level languages and higher-level languages. There are two types of lower-level languages: machine code and assembly code.

Machine code represents the very lowest level of software (closest to the actual electronic signals used by the computer itself). This code

(code means the same thing as language) looks like this:

01011101010100101010111010101010101010001010111010010101010.

Needless to say, writing programs in this language is tedious, error-prone and psychiatrically risky. Luckily, only specialists need ever use it (and even they seldom use it). All software must ultimately be translated into machine code, but this translation is itself automatically performed by still more software. This translation software (called a translator, compiler or interpreter) is either built-in to the computer or loaded using very simple commands, and presents no obstacle to users.

Assembly code is more widely used, but only by data processing specialists. Here is a sample:

```
BAL  R5,INPUT
LR   R3, PRICE
```

Assembly code is one step above machine code. Each statement can be easily translated into one group of machine codes. Many software packages are written in assembly code. Users usually cannot write assembly code. As a result, while assembly code programs are fast and efficient, they cannot be modified by users.

Both types of lower-level languages--machine and assembly--can be loosely referred to as "machine code." It is convenient to view machine code as being non-modifiable by most users, and leave it at that.

Higher-Level Languages

Higher-level languages are also called source code. They are the original source for later (automatic) translation into machine code or "object code." Except for commercially-prepared software packages, the vast majority of all programs are written in higher-level languages. Before proceeding to a discussion of the various languages, the significance of the higher/lower situation should be emphasized. Since all programs are ultimately translated into machine code, one computer can use many languages. This is a confusing point to many users, since most inexpensive small computers (called microcomputers) are sold with only one built-in language (BASIC). Most medium-price and higher-price microcomputers can be outfitted to use several languages.

Here is a thumbnail sketch of the major higher-level languages:

BASIC -- This is the most popular general-purpose language for users. It can be learned (on the simpler level) in 5 to 30 hours. In the past it was viewed as a weak language which was not suitable for serious purposes, but this attitude is changing. New "extended" or "business" BASIC's are quite powerful, and many complex problems can be solved with BASIC. Thirty to 100 hours are required to master the more complex BASIC's. By the way, "business" BASIC is quite suitable for educational uses since it emphasizes manipulation of English and user-oriented matters rather than scientific formulas.

While there are many versions of BASIC--each different--the most popular form is called Microsoft BASIC (after the company that distributed it) or MBASIC. It is so widespread that many call it generic BASIC. It is built-in to most inexpensive microcomputers, including Apple, IBM, Radio Shack, Atari and Texas Instruments.

COBOL and FORTRAN -- These two languages are the current standards for full-featured professional use. COBOL is a business-oriented language, while FORTRAN is scientifically-oriented. Both are standardized languages (unlike BASIC); an international committee fixes the syntax (choice and spelling of words) so that programs can be run on virtually any computer, worldwide. In general, users cannot use COBOL or FORTRAN effectively without taking a one-semester course, requiring from 150 to 200 hours of effort.

PASCAL and ADA -- These newer languages (along with others such as C and FORTH) are threatening the COBOL/FORTRAN preeminence, especially for microcomputers. PASCAL is most popular, but it is highly formalized and requires considerable logical precision. It was originally designed as a vehicle for teaching computer logic to computer science students. For many tasks, using PASCAL would be needlessly complicated since BASIC is both easier to use and equally capable.

User-Oriented Languages

The hybrid forms described below still lack a well-accepted descriptive term. They are software packages created especially for users. They are comparable in difficulty to BASIC. Yet they are not true general-purpose languages, since they are oriented to specific tasks. Even so, they are very much like general-purpose languages, so I shall call them user-oriented languages.

No matter what they are called, they are among the most valuable resources for users. Here are some descriptions:

AUTHORING LANGUAGES -- PILOT is the most popular authoring language. The term authoring, unfortunately, has little to do with traditional authorship. It has evolved into a term for the creation of educational and tutorial software. A better term might be "teaching languages." Nonetheless, PILOT and its relatives allow the instructor to create question-and-answer programs, keep track of the student's score(s), supply background material and ask separate questions depending upon the "mainline" questions missed, etc. While authoring languages are the only languages designed specifically for teachers or trainers, this does not mean that they are always the best choice for an educational goal--BASIC is still a viable alternative, as is a commercially-written software package.

Most teachers need only three skills to meet the vast majority of educational computing needs: BASIC, PILOT and the ability to properly evaluate commercially-produced software packages.

SPREADSHEET PROGRAMS -- Of most interest to business, math and science teachers, these languages (or software packages) allow the user to arrange numeric data in rows and columns. Changing just one figure causes all figures to be re-calculated automatically. Simple or complex equations can be used to define the relationship between rows and/or columns. Files of data can be saved for later comparisons and statistical manipulation.

The most popular spreadsheet programs are VISICALC, SUPERCALC and MULTIPLAN. It is said by many marketing experts that computer sales were greatly stimulated by the existence of these programs. Users were so impressed with the software that they bought computers solely because they ran spreadsheet programs.

DATABASE PROGRAMS -- Along with all of the other problems that exist with terminology, we must now confront the term "database." The software package/languages called "database packages" in the microcomputer world are not full-featured database systems as used by large computer centers. For microcomputers (of most interest to educators), there are two types: personal filing systems, and database programs. The personal filing system (example: PFS for APPLE) allow the storage and retrieval of simple but orderly data (imagine a 3x5 card file with notes on each card). The database programs such as DBaseII allow the creation of "forms" (much like paper forms) in which data can be stored and retrieved, along with powerful and flexible manipulation commands. Such programs are usually not useful for tutorial purposes, but have many administrative applications (budgeting, inventory records, enrollment figures).

LOGO AND TURTLE GRAPHICS -- New simplified graphics languages are very popular today at the elementary school level. One language is called LOGO, but the general type of graphics programming can be called turtle graphics since there is a simple symbol called a turtle that can be moved around on the screen to form drawings. These languages are not particularly useful today at the secondary/adult levels, but they are a precursor of things to come. It will be very exciting when we can use light pens (allowing drawing directly onto a TV screen) to "merge" drawings with LOGO-like commands. Stay tuned.

What Is The Difference Between Software Packages and Custom Programming?

By now it should be obvious that the computer field lacks standardized terminology. This is not a conspiracy to bedevil the beginner--just the result of an exuberant and creative evolution. For instance, we need terms to describe the new "hybrid" languages, to signify "modifiable by users," and better terms for "database" packages.

Let's review. What most people mean by the term "programming" is the use of general-purpose higher-level programming languages such as BASIC, COBOL and PASCAL. Users seldom write programs in assembly code or machine code. Users can learn BASIC fairly easily, and can take advantage of software packages such as SPREADSHEET PROGRAMS, DATABASES, and AUTHORING; these packages are specifically-designed for users with little computer experience (although they are a bit more difficult than advertisements would suggest!).

Software packages are commercially-prepared programs. Programs such as VISICALC (spreadsheet), DBaseII (database) and WORDSTAR (word processing) are so powerful and useful that we can view them as user-oriented languages in their own right.

There are many types of software packages. Tutorials are used to teach (about any subject, or about computers or still more software packages). Games are strictly for entertainment. Utilities perform useful functions, such as keeping track of students' scores. There are even party-game packages: ELIZA is a crackpot psychoanalyst that diagnoses your id with hysterical results; LOVERS OR STRANGERS asks a series of questions about your love life; and there are now X-rated packages!

There are two important questions about any software package which users must ask: is it written in machine-code or a higher-level language, and can it be modified?

If a software package is written in machine code, it cannot be modified by users (without extreme effort and expense, that is). When we say "modified" we are not referring to those built-in options and functions which exist when the program is used under normal circumstances. For instance, VISICALC has hundreds of techniques for entering, changing and storing data. By contrast, suppose a teacher buys a health-education software package. After a few years of use, the information becomes outdated. If the teacher could modify the program, current material could be substituted for the old material, thus changing the original design of the program slightly. If the program were written in BASIC, it could probably be modified. (Note: several technical methods can be used by software suppliers to make it impossible to "get at" the actual BASIC.

A program must be advertised as "user modifiable" before one can be confident that it is.)

Today, few software packages are user-modifiable. This is an area of great interest to educators, and a source of continuing frustration. Suppose you locate a software package which performs 95% of the functions desired. It would be ideal if you could modify it to accomplish the last 5% of the goals. Unfortunately, this is seldom possible at the present time.

Software suppliers are reluctant to allow user modifications since their software would be easily "pirated." Sadly, educational users (along with most others) are well-known for their pirating behavior. In the future, new pricing schemes and anti-pirating technologies may improve the situation. Professional educational associations should become involved in this issue since it is unlikely that the situation will change without active involvement in licensure matters.

How Can You, As An Educator, Get Involved In Programming?

While there are many avenues for education, I am going to suggest a plan for your education in programming. It is based on the assumption that you do not want to attend a semester-length COBOL or FORTRAN course, and that you do not want to become a data-processing specialist.

STEP ONE -- Computer Concepts. It will benefit you greatly, in the long run, to begin with an orientation to computers. There are really only 3 options--courses, seminars and books or book/software packages. Adult education courses are offered in some areas, but their quality varies widely (for most DP teachers, they are a low priority). A VTAE institution may be able to create a course specifically for teachers. Seminars and in-service presentations are more compact and specialized--but their availability and quality is hard to predict. Here is the only book I can recommend with complete confidence:

INTRODUCTION TO COMPUTERS & DATA PROCESSING
Author: Shelly & Cashman
Publisher: Anaheim Publishing Company
2632 Saturn Street Brea, CA 92621
(714) 993-3700. $18.95

There are a few new book/software tutorial combinations available. If you are interested in this approach, you should try to organize a group of people who use the same computer and research the area. New packages are appearing every day, from both established publishers such as McGraw-Hill, Prentice-Hall, Addison-Weseley and CBS/Holt and from independent, new publishers. Your librarian may be able to suggest methods for locating the material, using one of the new educational software indexes.

STEP TWO -- BASIC. I feel that BASIC remains the best avenue for building confidence and useful skills. It is also the most accessible approach. One cautionary note: learning BASIC without good computer-concepts skills can produce the illusion that one knows a great deal about computers! Under such circumstances, moving beyond simple programs will present obstacles.

There are two ways to learn BASIC--with a course, and by purchasing your own computer or finding access to one. A 10-week adult education course would be more than adequate for most educators. If you purchase a computer, or use one, the quality of the accompanying tutorial BASIC manual becomes critical. The best tutorials (printed) accompany the RADIO SHACK, IBM and APPLE computers. The new APPLE--IIE (enhanced) has a superb tutorial which also has good computer-concepts material.

Examine the written materials for other brands carefully before plunging! The machines which are the best "bargains" in terms of hardware seem to have the worst manuals...

There are many books about BASIC on the market, but their quality varies dramatically. Here is the best BASIC textbook on the market, but it may be too detailed for many users:

INTRODUCTION TO BASIC PROGRAMMING
Author: Shelly & Cashman
Publisher: Anaheim Publishing Company
2632 Saturn Street Brea, CA 92621
(714) 993-3700. $14.95.

It is so much more fun to learn BASIC while using a microcomputer that one should think twice about using a book alone. However, to move beyond very simple BASIC, a good textbook is invaluable.

STEP THREE -- EVALUATE YOUR GOALS. Do you want to concentrate upon evaluation of commercially-written software packages? Do you want to be able to write BASIC and PILOT tutorials on your own? Do you have specialized administrative and word-processing needs? Do you want to buy your own computer? Can you cooperate with a group of colleagues to acquire hardware and/or software?

STEP FOUR -- EXAMINE PILOT. Most teachers will want to examine a PILOT tutorial or manual to determine its value for their goals. In general, PILOT can be learned "on your own" using the manuals provided by the manufacturer, so long as you have adequate computer-concepts preparation. The PILOT user also needs some assistance from a more experienced user in the area of floppy-disk handling and file usage for the specific brand of computer used.

STEP FIVE -- SOFTWARE EVALUATION. Educators need to learn more about software evaluation--not only for their own needs, but for future student tutorials. For instance, a teacher might want to evaluate WORD PROCESSING, SPREADSHEETS and an AUTHORING package for their own purposes (including future preparation of tutorials). The same teacher might also be a part of a committee charged with locating and evaluating tutorial software in a specific subject area.

No matter what the purpose, here are some typical steps in the evaluation process:

a. Gather written material about the software package from the manufacturer and from written reviews in the computer periodicals (many periodicals are now indexed--see librarian).

b. Seek advice of users who have the package, if possible.

c. Try to arrange a live demonstration of the package from a dealer. You might also be able to borrow a review copy from the manufacturer (unlikely if the package is easily copied!).

d. Determine whether your educational association has any information on the package. Check the new educational software evaluation services at the library.

e. After purchase, the software should be tested. If it is tutorial software for student use, it should be field-tested using normal educational-evaluation methods. Comment: standards should be higher for computer-based instruction than for print-based instruction due to the need for detailed operational instructions and the lack of modifiability.

f. If you place the software "into production" in an educational setting, a back-up copy of the software and its documentation should be placed in a secure place (even a vault).

A note on documentation: the accompanying written materials are often as important as the software itself. Also, you may need to produce and test two additional items:

a. Instructions for students about how to load the software, and keyboard usage (for your brand of computer).

b. Student self-scoring sheets (on paper) or other paper-based feedback devices.

Summary

It is hoped that this grand tour of the computer world has been pleasant for the reader. Perhaps computing does not seem so formidible now. The most important point to remember is that the three major programming tools of interest to educators--BASIC, PILOT and software packages--have all been specifically designed to be user-oriented. Whether "user-oriented" means "easy, convenient and understandable" --to you--can only be determined one way: by trying it. Good luck.

AUTHORING SYSTEMS FOR COURSEWARE DEVELOPMENT

by Bruce DeBoer
Moraine Park Technical Institute
Fond du Lac, Wisconsin

INTRODUCTION:

If you are in education and if you have taught with a computer, you have most assuredly wished at some point that someone would design software packages that teach what you want to teach and present the material in the manner and sequence that you find best suits your students. Well stop wishing and do it yourself! There are a number of software packages on the market today called authoring systems that allow even the most "non" of "nonprogrammers" to design software quickly and efficiently. This short paper will give you a working definition of authoring systems and tell you what to look for when selecting an authoring system.

WHAT IS AN AUTHORING SYSTEM?

An authoring system is a software package that allows the author to create lessons, tests, or tutorials by simply choosing from a menu and typing information onto "template" screens that have been formatted by the program to accept text, questions, graphics or combinations of each. The order and sequence in which the material is presented is determined by the author. Usually some form of record keeping is provided.

HOW DO THEY WORK?

To create a lesson using a typical authoring system we would simply load and run the program. A menu would then appear on screen allowing us to choose from a number of options. A typical menu appears below:

```
AUTHORING SYSTEM- MAIN MENU

1. CREATE a new lesson.
2. REVIEW or MODIFY a lesson.
3. REVIEW Student results file.

ENTER THE NUMBER OF YOUR CHOICE >
```

Choosing NUMBER 1, we would then procede to create a new lesson. A new screen would appear and we would be asked to type in the name of the lesson and press enter. Having done so the following menu would then appear.

```
AUTHORING SYSTEM- LESSON CREATION MENU

     Please choose from the list below

     1. Create a TEXT screen
     2. Create a QUESTION screen (Multiple Choice)
     3. Create a QUESTION screen (Fill-in)
     4. SAVE the lesson to disk.
     5. Exit to main menu.

     ENTER THE NUMBER OF YOUR CHOICE >
```

Choosing NUMBER 1, the screen would go blank except for an information line and we would be instructed that this is a text screen and that we should TYPE in the text that we wish to have displayed. These instructions will usually occur at the bottom of the screen.

For our example we will do a short tutorial on stamp collecting. Our first text screen will simply be the title of the lesson.

```
              A SHORT TUTORIAL

                     on

              Stamp Collecting
```

Having typed in the title and pressing the appropriate key to indicate that we are done with the screen, we would be asked to indicate which screen number this is to be in the lesson. SCREEN #: (we would simply enter 1 indicating this is the first screen). The program would then take us back to the CREATION MENU.

Again we would indicate that we want a text screen and when it appears we would type the following:

```
Stamp collecting is called philately. So a person
who collects stamps is called a philatelist.
There are an estimated 16 million philatelists in the
United States alone.

Stamp collecting, the world's most popular hobby, got
it's start only a year after the introduction of the
postage stamp. And if you think postage stamps have
been around for centuries, think again. The first
appeared in England in 1840.
```

This time we would save SCREEN #: 2 to indicate that this screen should appear after the title screen.

Again returning to the CREATION MENU we are presented with the option list. Let's take option Number 2 and prepare a multiple choice question. A "template" similar to the following would appear. The cursor would be flashing after the colon (:) following the word INSTRUCTIONS.

```
INSTRUCTIONS:


QUES.#      :


A.
B.
C.
D.

ANS:
```

We now would type in the instructions to the student, the question number, the response choices, and the letter of the correct answer as follows. After we type in the instructions we press <ENTER>, the cursor will move to the question number blank and then the question area etc. until we are through entering all the information and again press the control key indicating that we are through with the screen.

We would type in the questions as follows.

```
INSTRUCTIONS: Please choose the best answer from those
given below. Type in the letter of your choice and press
<ENTER>.
QUES.# 1  : What is another name for stamp collecting?


A. lapidary
B. stampography
C. philately
D. effectuation

ANS: C
```

After we have entered the question and the response choices a typical program might now provide us with the opportunity to provide feedback to each specific incorrect answer and a response to the correct answer. For example:
The screen might read-
What is the message if the student takes choice A?

and we would type a response such as: Sorry, Lapidary is concerned with the art of cutting gems.

When-we have entered feedback for each answer choice the screen would be saved as SCREEN #: 3.

Returning to the menu we now might choose Option 3 for a fill-in question.

Again we would be provided with a "template" and would fill it in as follows:

```
INSTRUCTIONS: Please answer the following by typing in the
answer and then pressing <ENTER>

QUES. # 2  : In what country was the first postage stamp used?


ANS:< ENGLAND!BRITAIN!GREAT BRITAIN
```

Note: A typical program will allow a number of acceptable answers. Here we will accept ENGLAND, BRITAIN, and GREAT BRITAIN. The symbol -!- is a means used in our sample program to separate answers.

Again we would save the screen by indicating a screen number.This time SCREEN #: 4.

And that's how it is done.

Our program could now be used by the student. When the program is run the title screen would appear and the student would be prompted at the bottom of the screen to <press enter to continue> . When <ENTER> is pressed,screen two (2) would appear, the <ENTER> prompt, then the questions etc. If the student answers incorrectly the feedback would be provided.

At the end of the lesson the student's score might be recorded to the diskette for future reveiw by the instructor.

HOW TO CHOOSE AN AUTHORING SYSTEM:

Many authoring systems contain a number of options not discussed in the previous example . Just what are some of the others and what should we look for in attempting to choose the authoring system that is best for us?

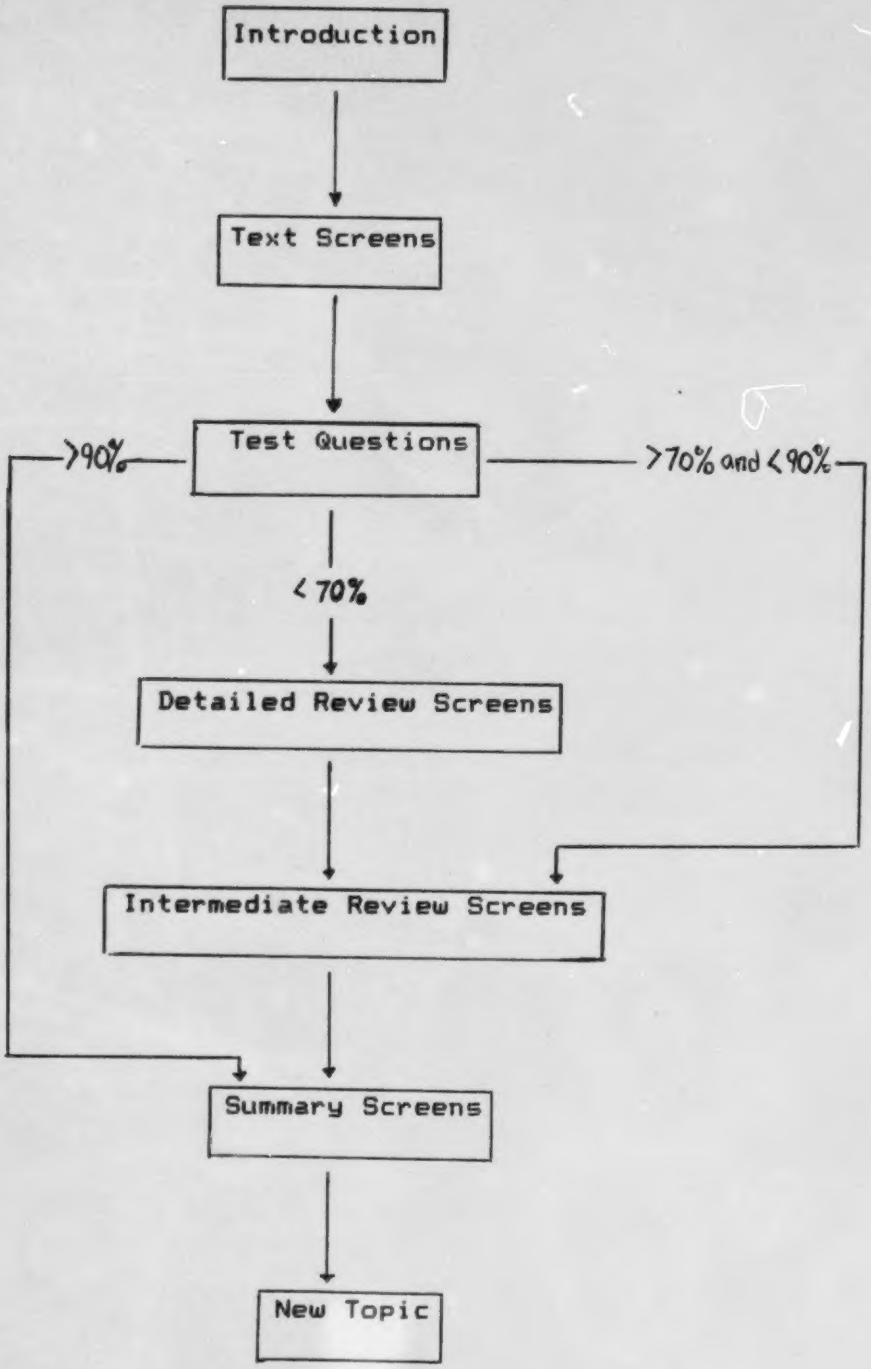
The following is the primary question that should be considered. What software is available for your computer? You will be forced to limit your choices to your brand of computer and its specific capabilities. For example: Does the software require two disks drives? What memory is required to run the program?

-Assuming you have a number of authoring software systems available for your computer, you must now consider the next question. Just what type of lessons do you want to author? Once you have made that decision the following the features and capabilities of the software should be considered.

1. Does lesson sequence structure allow branching?

Although you may wish to present the same lesson in the same straight-line sequence to all students on some occassions, the real power of lessons delivered by microcomputer is that the flow and sequence of the material can be individualized. The student may be provided with as little or as much of the lesson as deemed appropriate by the computer based on how the student answers specific questions and the standards you as the author have set for specific branching. Some systems allow very complicated branching based on the percentage of questions a student has answered correctly in a series of questions based on the previous text material. An example of an actual flowchart from such an authoring system is given on the next page.

Text material is presented. A test is given. Based on the test results the student may skip all review material or be given a portion of it as determined by the percentage of correct answers. The percentages are set by the author during the creation of the program.


Introduction
Text Screens
Test Questions
>90%
>70% and <90%
< 70%
Detailed Review Screens
Intermediate Review Screens
Summary Screens
New Topic

Another very important sequencing question. Does the program allow the student to review a previous screen with just a single key input? In learning by means of computer text as well as learning by means of paper based text materials the student often finds the need to review a previous page. A good program will allow the student this opportunity.

Does the program allow temporary exit to hint, help, and glossary screens during execution of tutorials? Some systems have excellent user control of flow and sequence in these areas.

Although some authoring systems allow more specific sequence control and branching capabilities than others, it is still important to remember that in all cases your program design will be limited to what the system offers.

2. What question formats are allowed?

Authoring system question formats range from single format programs such as "templated" multiple choice to systems that allow almost any type of questions on "nontemplated" text screens. The software package you choose will depend on the type and variety of the questions you will incoporate in your program.

If you are using completion items you must also consider the fact that there may be more than one answer for a particular question. In such case you should compare the various systems in terms of their answer matching options. Some systems require a perfect match. Some systems scan the student response for short sequence of matching letters thereby allowing for minor errors in spelling. Some systems allow only a single response to be matched, while others allow a list of possible responses to be checked by the letter scan or perfect match.

3. Do you have control over the number of trys a student is given to answer a question, or the length of time a question appears on the screen?

Some systems allow the student an infinite number of chances to answer a specific question while other systems allow the author to limit the trys to as few as a single attempt. Along with this feature some systems "mark" the question wrong after the first attempt while others may be "programmed" by the author to allow "relaxed scoring" with credit still given on the second and third attempt.

Some systems also allow the author to control the length of time a question appears on the screen. This may be a very important feature in testing skill areas where an immediate and accurate response to particular questions is important.

4. What graphic capabilites will you need?

Not all authoring tools take advantage of the graphic capabilities of the computer for which they were written. And even if they do, the ease of programming graphics ranges from easy to very complex to produce virtually the same type of graphics display. If you need graphics, check very carefully the ease of creating graphics screens and whether or not text and graphics can easily be displayed on the same screen.

5. What type of record keeping does the system do?

The amount of information stored by various systems ranges from as simple to the student name, name of lesson, and score to as complex as the name of student, name of lesson, date, time of day, time spent on the lesson, score, which questions were answered incorrectly and the answers each student gave to each question. Some systems are complex enough to actually manage the student's progress through a series of lessons by keeping track of the previous level of achievement and slotting the student into the lesson most appropriate to their present skill level.

SOME AUTHORING SYSTEMS CURRENTLY AVAILABLE:

For the Apple II+:

A.I.D.S: Lesson Authoring, Branching
Skill Corp Software, Inc.
1711 McGaw Avenue
Irvine, CA 92714

Block Author System : Lesson Authoring, No Branching
California School for the Deaf
Computer Lab
39350 Galludet Drive
Freemont, CA 94538

Courseware Development System I: Lesson Authoring: No Branching
Bell & Howell Company
7100 N. McCormick Rd.
Chicago, IL 60645

OMNITEST: Test Authoring, No Branching
Educational Computing Systems
136 Fairbanks Rd
Oak Ridge, TN 37830

SOFCRATES: Lesson Authoring, Branching
Simpac Educational Systems
Suite 11-C
1105 N. Main St.
Gainesville, FL 32601

ZES Authoring System: Lesson Authoring, Branching
Avant Garde Creations
P.O. Box 30160
Eugene, Oregon 97403

For the Apple and IBM-PC:

The Author: Lesson Authoring, Branching
Pheonix Performance Systems, Inc.
324 South Main, Suite #1
Stillwater, MN 55082

For the TRS-80 Model I and III

Author I: Lesson Authoring, Branching
Radio Shack
Education Division
400 Atrium , 1 Tandy Ctr.
Forth Worth, TX 76102

CAIware 3-D: Lesson Authoring, Branching
Fireside Computing
5843 Montgomery Road
Elkridge, Maryland 21227

Quick Quiz: Test Authoring, No Branching
Radio Shack
Education Division
400 atrium, 1 Tandy Ctr.
Forth Worth, TX 76102

Administration
# of a
Microcomputer Laboratory

by
Jeanette M. Richardson
Office & Marketing Supervisor

Wisconsin Indianhead Technical Institute
New Richmond Campus
March, 1983

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Wisconsin Indianhead Technical Institute
New Richmond Campus

Managing a Microcomputer Laboratory that encompases a multidisciplinary approach can prove to be a rewarding and challenging management prospect or it can be a frustrating and complexing job. The key to success is administrative and instructional staff support, advance planning, and communication.

The New Richmond Campus of Wisconsin Indianhead Technical Institute has within the last year put into operation a microcomputer laboratory, commonly known on campus as "The Apple Orchard." Although not a large facility, it serves the needs of the majority of the campus including the Office & Marketing Division, Agriculture Department, and some general education classes.

The present facility is--after only a year in operation--buldging at the seams! In the beginning, most of the faculty had not used a microcomputer as an instructional support tool or had hands-on experience in using one. Today, an increasing number of instructors are asking for instructional time in The Apple Orchard; and scheduling--both day and evening--has become a major concern.

How did this rapid change come about? Why are so many faculty incorporating the use of microcomputer software into existing courses? Why is the lab in operation almost continually from 8 a.m. until 9:30 p.m. five days a week? Why is campus management considering expanding into Saturdays and possibly Sunday afternoons as well?

The need to incorporate computer instruction and applications into curriculum was identified by both management and instructional staff, and an orderly process was put into operation to accomplish this task. Timelines for implementation were established, administrative support was given, and--most importantly--faculty members involved in the planning, implementation, and evaluation steps.

The rate of technological change today and the rate that individuals can adapt to this change leaves a managerial gap which must be addressed. (See Exhibit A.) In addressing this, the following nine steps were used in assisting the campus management team in developing, implementing, staffing, and integrating the Apple Orchard microprocessing lab into the total instructional process.

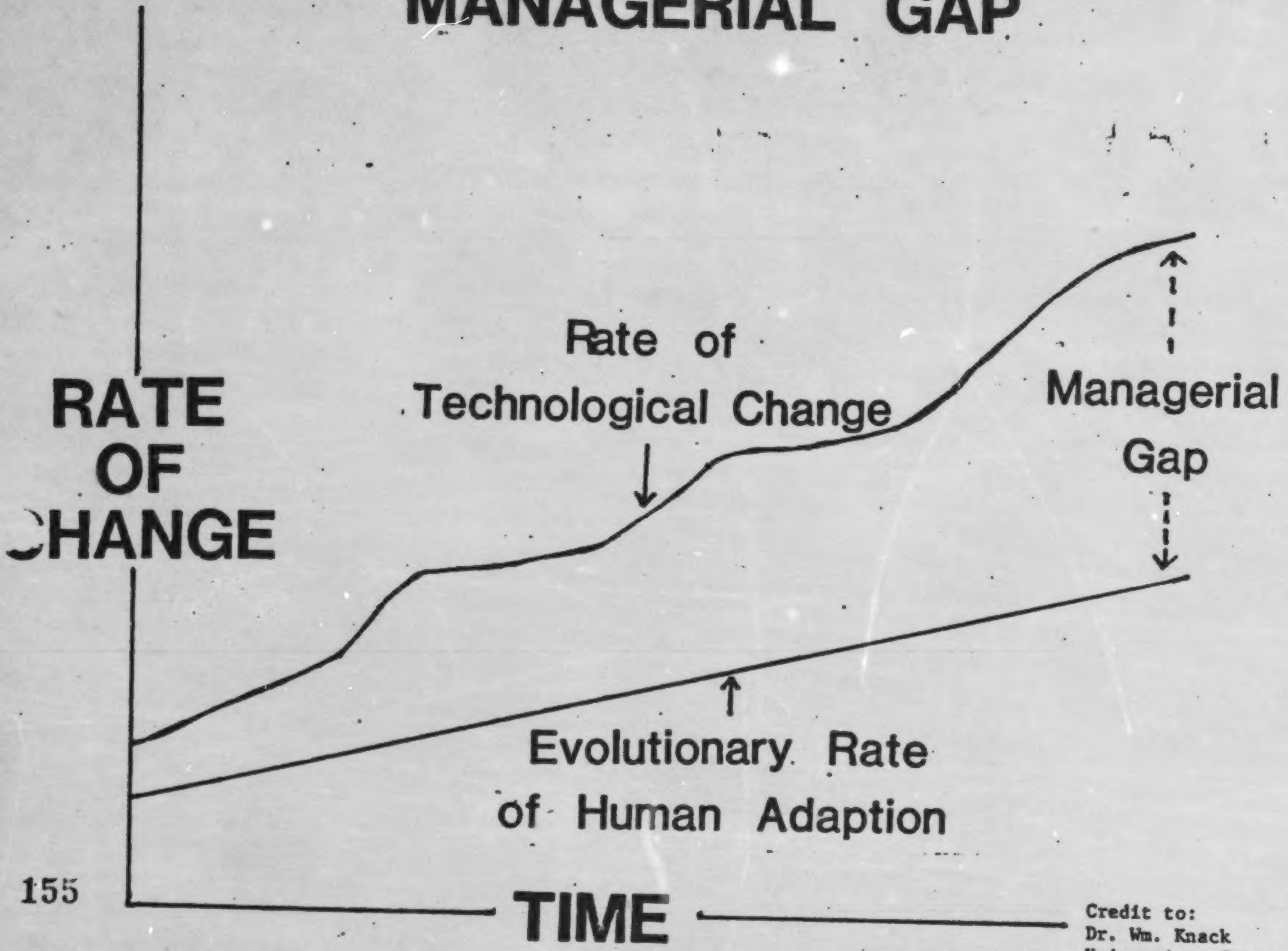
1) Establish goals and objectives
2) Specify evaluation criteria
3) Identify and organize planning structure and team
4) Access resources
5) Design system for implementation
6) Train staff
7) Design a recordkeeping system
8) Adapt/construct facilities
9) Adapt organizational structure

Goals & Objectives

With the assistance of local advisory committees, the need for training in computer literacy was established. The rapid changes in

MANAGERIAL GAP

EXHIBIT A



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today's business offices, on the farm, in manufacturing industries all indicated without question the need for basic computer concepts to be included in the curriculums. The actual amount of time and application to instruction was denoted by each area in the various technical fields.

In addition, applications were noted for adult basic education in such areas as reading, math, spelling, and grammar. Adults enjoy using the computer to perform what is generally regarded as remedial instruction. In this way, both the goals of computer literacy and educational fundamentals could be easily accomplished.

The inter-disciplinary utilization for the lab was established for a number of reasons. The main one, understandably, was the budget available to support the purchase of microcomputers. If each division/area would function as a separate unit and house the terminals in general classrooms, the availability for use of this equipment would be not allow for flexible scheduling. Therefore, management made the decision to establish one lab for use by the entire campus.

It was also an objective to foster a cooperative spirit among faculty from all divisions using this lab. The Campus Administrator designated the Office & Marketing Division Supervisor as coordinator for the development of the lab and related procedures, to work cooperatively with other areas of the campus.

Evaluation Criteria

This criteria as designated by management included a number of diverse areas:

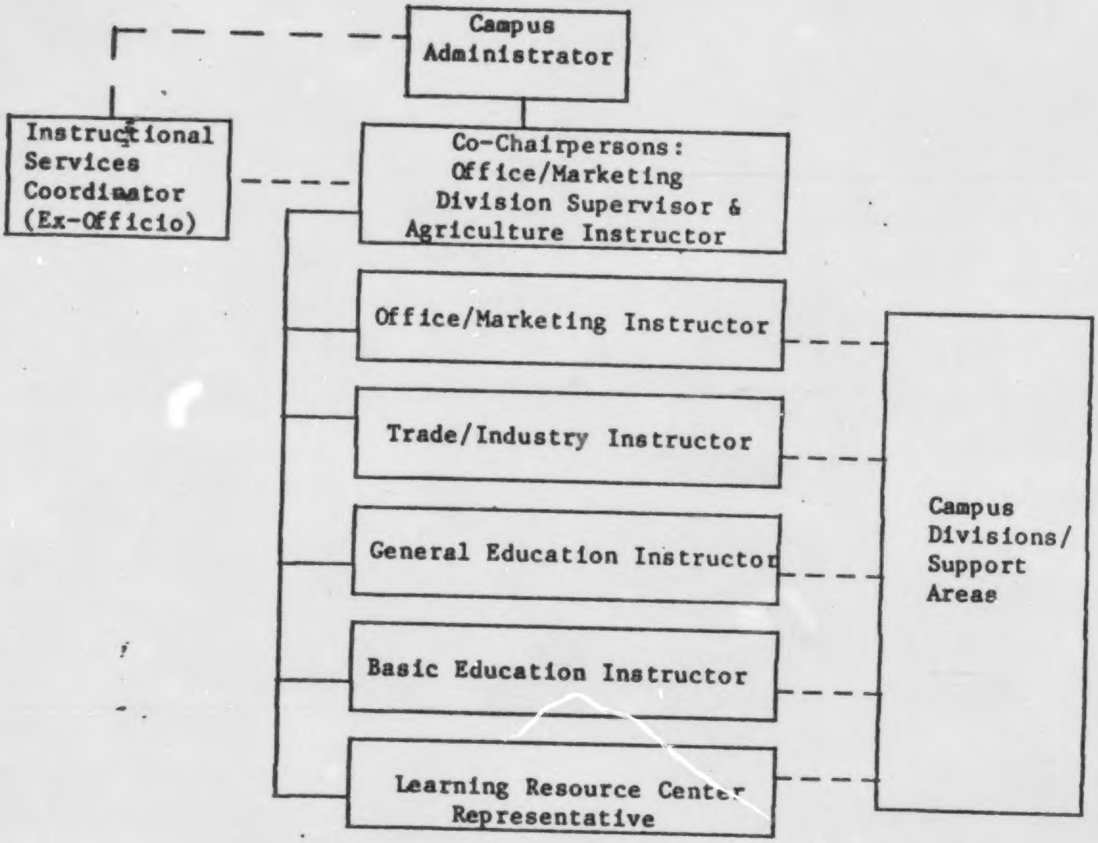
1) Inservice activities for campus instructional and management staff
2) Establishment of management procedures for lab
3) Software and hardware purchase/inventory procedures

4) Role clarification/procedures for Learning Resource Center
5) Establishment of machine maintenance and safety procedures
6) Role clarification of Campus Bookstore
7) Physical location of lab
8) Inter-disciplinary cooperation in use of lab
9) Budget for implementation and maintenance

These areas were set to be evaluated by campus management at the end of the school year. New criteria could be added as the need was shown throughout the year.

Planning Structure

A campus committee was formed in the fall to proceed with the establishment of guidelines for implementation of the microcomputer interdisciplinary laboratory. Co-chairpersons were identified by the Campus Administrator: The Office & Marketing Division Supervisor and an instructor knowledgable in microcomputer use from the Agriculture Department. Each division/area of the Campus nominated one instructor or support staff individual to serve on the Ad Hoc Data Processing Lab Committee. The make-up and organization of this committee was as follows:


Campus Administrator
Instructional Services Coordinator (Ex-Officio)
Co-Chairpersons: Office/Marketing Division Supervisor & Agriculture Instructor
Office/Marketing Instructor
Trade/Industry Instructor
General Education Instructor
Basic Education Instructor
Learning Resource Center Representative
Campus Divisions/ Support Areas

Each representative on the committee served as a liasion to his/her division or area. The co-chairpersons served as the committee's representatives in discussion with the Campus Administrator; the Instructional Services Coordinator was identified as an ex-officio and support staff committee member.

The committee was charged with developing and recommending procedures for lab management; student and instructor use of the lab; software requisitioning, receiving, and catalog procedures; bookstore responsibilities/involvement; machine maintenance and security procedures; lab safety rules; as well as recommending instructional inservice activities. A budget was recommended for implementation. It should be noted that generally committee members met on their own time or during scheduled office hours; this group operated in many respects much like a "quality circle."

One area that cannot receive too much emphasis is the role communication played in the developmental stage of this project. Both the campus management team and faculty were kept informed through one-on-one conferences and committee minutes as to the progress and recommendations being made by the committee. Concerns were discussed as they arose.

By the time The Apple Orchard officially opened, the staff (and students) were ready and eager to make use of this new facility.

Resource Assessment

The most obvious assessment is that of the actual budget available to support the lab. This was recommended by the Campus Administrator and communicated to the committee in the early stages of development.

Software adaptable for instructional purpose was investigated. At the time the lab was being orgainized, the greatest variety of instructional software available at an affordable cost was programmed to run on the Apple brand of hardware. The New Richmond campus proximity to Minnesota and the availability of MECC software was also considered.

The availability of "people" resources cannot be overlooked. The staff had at that time one instructor in the agriculture department (co-chair) who was very willing to share his expertise with other staff members. Four or five other staff members who had some basic knowledge also willingly lent their time to helping with the technical details.

Individuals from the local CESA agency and nearly universities were also called upon to assist.

Management Implementation Procedures

Lab Manager. Since on the WITI-New Richmond Campus The Apple Orchard is operated part of the time as an open lab, some workable form of control had to be put into place that could be monitored with relative ease. Since the campus budget could not support a paraprofessional at the time, the committee recommended that an instructional staff member be designed as lab manager to facilitate operations.

Student Users Guide. In consultation with the area CESA agencies and the University of Wisconsin campuses at River Falls and Whitewater, the committee adapted a "Student Users Guide for the Apple II+ Microcomputer" for use on Campus. Each student purchases this guide for a nominal cost from the campus bookstore. It contains information necessary to competently operate the microcomputer units.

Authorization Card. Before using a microcomputer, however, users must show proficiency by passing two short exams. After successful completion of these exams, a student is issued by the instructor a "Computer Use Authorization" permit card (See Exhibit B) developed by the committee.

The following procedures are in effect in the lab:

(1) Each user must obtain a Computer Authorization Card from the instructor before using a micro-computer terminal. This will be issued to the user only after s/he has successfully completed both of the following tests: Computer Language Test #1 and Computer Operation Test #2.

EXHIBIT B

WITI NEW RICHMOND

Last Name First

Course Name - Number

Instructor(s)

Date Issued

> This Computer Use Authorization is your permit to operate computer terminals and to check-out - on a one-hour reserve - software materials from the LRC.

1. This card should be filed in the Lab at all times except:
   (a) when you are requesting software from the LRC or
   (b) when properly displayed while you are operating a computer terminal in the Lab.
2. Enter the date and times you work in the Lab on the back of the card. This is your verification record.
3. Under no circumstances may you loan this card to another person.
4. If your card is missing, notify your instructor immediately.
5. Follow posted safety and repair procedures at all time.

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TIME OUT													
TIME IN													
DATE													
TIME OUT													
TIME IN													
DATE													
TIME OUT													
TIME IN													
DATE													

LRC Software Checkout

TIME OUT			
TIME IN			
DATE			
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DATE			
TIME OUT			
TIME IN			
DATE			

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(2) The permit card should be displayed at all times in the card holder assigned to the machine when the user is operating a terminal.

(3) Each user should log in time and date on the card for each terminal usage.

(4) Under no circumstances may a user loan his/her card to another individual.

(5) If card is lost, user must notify lab manager at once.

When an authorization card is issued to a student it also indicates that s/he may check out software from the Learning Resource Center. The LRC checkout procedure states that users may check out on a one-hour reserve basis a diskette (and optional instructional booklet) as designated by the course instructor. The LRC is open during customary day hours as well as designated evening hours.

Sign-Up Procedures. In order to maintain an accurate account of individual terminal use, each microcomputer is assigned a "Computer Use Log." Instructors may reserve terminals as needed for their classes. In addition, users can reserve one-hour blocks of time on individual terminals when the lab is not scheduled for a class. These logs are changed weekly by the lab manager and are maintained for reporting purposes.

The following procedures are in effect for use of the terminals:

(1) User should sign his/her name on the day and hour terminal is requested.

(2) A terminal is reserved for use until 10 minutes after the specified hour. After that time any authorized individual may use terminal;

user is thereby cautioned to be prompt in arriving at station reserved.

(3) Only one consecutive hour may be scheduled by a user.

(4) Terminal reservations may be made only one week in advance. Sign-up sheets for the following week are posted on Friday morning of the preceeding week by the lab manager.

(5) If a time frame is "X'ed" out, the equipment is available only to an assigned class and/or instructor and may not be used for open lab work.

(6) Each person using The Apple Orchard is responsible for care of terminals, diskettes, instructional books, etc. Work areas should be cleaned and normal housekeeping procedures observed.

(7) Lab manager should be notified regarding special problems immediately.

Maintenance & Inventory. A systematic approach to machine maintenance was a necessity. With minor modifications, the procedure already in place for the Office & Marketing Division was implemented.

Each user is responsible for machine maintenance in The Apple Orchard. If a terminal needs repair, it is the user's responsibility to see that a proper notation is made on the repair card for the lab manager's information. Presently a repair contract is in operation with the area CESA agency. The following procedures are followed:

(1) Each terminal, disk drive, and monitor is designated by a number.

(2) This number corresponds to a card in the Maintenance Card File.

(3) The student locates the proper card, notes on the next open line what is wrong with the machine, then initials the card.

(4) The card is placed behind the guide labeled "Repairs Needed."

(5) A piece of masking tape about 3" long is put on top of the piece of equipment needing repair. This notifies the lab manager that the terminal, disk drive, or monitor is in need of repair.

For inventory purposes, each terminal, disk drive, monitor, printer, etc. is assigned a number in the lab. This number serves a number of purposes. Students can log in reserved time for a designated station; the authorization card is shown in the numbered magnetic clip assigned to each station; maintenance repair cards are coded using these same numbers.

Safety Procedures. All users are required to be sure to adhere to safety procedures developed by the committee. Although most of these rules would appear to be "common sense," they are posted in The Apple Orchard for easy referral and as a reminder to lab users.

(1) All electrical cords must be kept clear of traffic areas.

(2) No equipment may be lifted or moved from its station without first consulting with lab manager.

(3) All drawers and cabinet doors should be kept closed when not in use.

(4) Aisles and walkways should be kept free of furniture, equipment, etc.

(5) Bracelets, hair, loose clothing/accessories should be kept away from movable machine parts.

(6) All items should be returned to their proper place after use.

(7) Chairs should be placed under desks when not in use.

(8) The lab manager should be notified of any potential safety hazzard immediately.

Security Procedures. Equipment security is essential in the Apple Orchard. Therefore, the campus welding class manufactured a simple, right-angle triangle devise (see Exhibit C). One side of the triangle is attached to the equipment. A security chain is then looped through the other side; this chain is locked to the desk top or floor. This procedure is repeated for every piece of equipment in the lab.

Staff Orientation

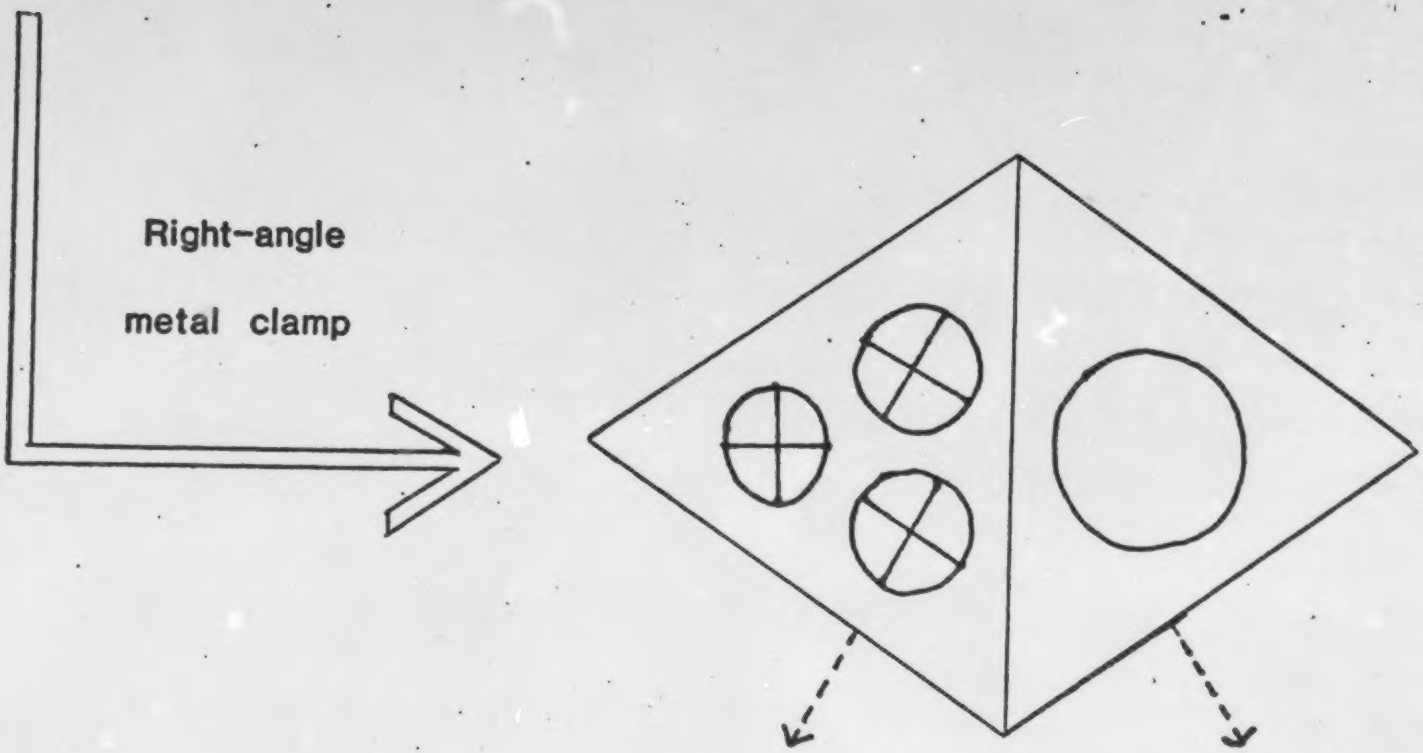
Any new instructional technique can be met with negative reaction. However, for the most part, this was not the case in implementation of the microcomputer lab on campus. Probably the acceptance is due in part to the inservicing given to both management and instructional staff.

A day-long inservice was conducted by area CESA personnel. Campus staff knowledgeable in the microcomputer area assisted. Prepared software in discipline areas was demonstrated, and each staff member had the opportunity to receive hands-on experience on a terminal before the end of the day.

In addition, evening courses have been conducted by the agriculture instructor who also served as the campus committee co-chair. These classes, open to community as well as campus staff at nominal cost, have been instrumental in bringing together individuals from a variety of interest areas. As commercial software has become more available, adaptations to instructional areas have continued to increase. Some staff has enrolled in programming courses and are developing their own software. Campus divisions willingly share information; the inter-disciplinary Apple Orchard has brought all campus departments together into a working relationship.

SECURITY CLAMP

EXHIBIT C


Right-angle
metal clamp
Attached
to machine
Security chain
looped through and
attached to floor or wall.

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More recently, a district computer specialist has been hired who is available to assist both management and instructional staff with technical concerns as well as in developing software instructional packages. This individual and the campus lab manager work closely together to support The Apple Orchard concept of maintaining a working inter-disciplinary campus approach to lab utilization.

Recordkeeping

In order to maintain an equipment and a software inventory, all purchases are coordinated through the LRC. This helps to avoid duplicaton of purchases and assure availability materials to all staff and students.

Software security is also a concern. To assist in identifying campus material, a bright green label was designed and is affixed to each software package received by the LRC.

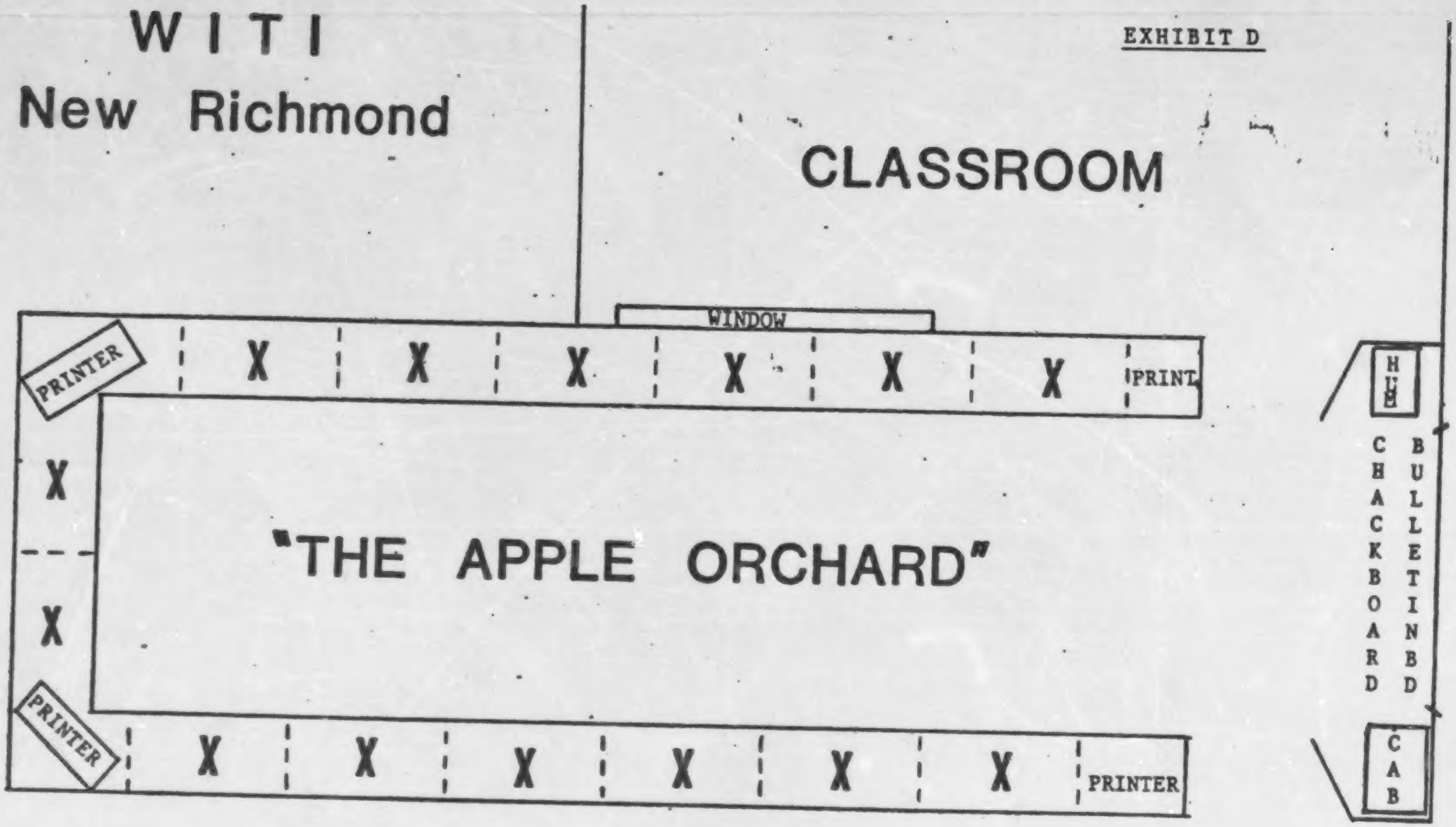
Campus Facilities

The New Richmond Campus, when designed less than ten years ago and constructed in 1976, did not plan for a microcomputer lab. Therefore, facilities had to be adapted to meet this need.

After much deliberation by the committee and the campus management team, The Apple Orchard (see Exhibit D) was located in the Office & Marketing Division area and near the LRC for ease in obtaining software for instructor and student use. An adjacent lecture classroom was denoted as necessary. Since instructors would have to work with students in both the classroom and lab during the class period, a window was installed between these two areas.

WITI
New Richmond

EXHIBIT D


CLASSROOM
WINDOW
PRINTER
X
PRINT
HUB
CHACKBOARD
BULLETIN BD
"THE APPLE ORCHARD"
PRINTER
CAB

X = Apple II Units
Keyboard
Monitor
Terminal
Ten-Key Pad

--- Hall ---

Terminals are served by printers on a 3:1 or 4:1 ratio. A switch box was designed by the local CESA agency staff at nominal cost and installed by the lab manager.

A chalkboard and bulletin board were found to be a necessity as was a humidifier; chairs without rollers have been found to produce less static.

Since the New Richmond campus is experiencing a large growth in student population, a building addition is in the planning stages. When The Apple Orchard is relocated, physical facilities will be designed specifically to meet the needs of this inter-disciplinary microcomputer lab.

Adaptive Organizational Structure

The goal of establishing a microcomputer lab on campus has become a reality. It is, however, a changing structure which must be continually adapted to meet instructional needs.

The Ad Hoc Data Processing Lab Committee is today--a year after its conception--a standing campus committee, under the direction of the Instructional Services Coordinator. Committee membership is made up of instructional staff from each campus department and the LRC. Procedures have been modified and refined.

Evaluation is an on-going process. Repair procedures are of major concern. Also, a greater demand is being made on the lab manager's time as more staff and students request time in The Apple Orchard. Additional inservice time is required as new staff is hired. Facilities are in need of enlarging as more equipment is purchased.

These concerns and opportunities can be handled with relative ease because the basic organizational structure for implementation is in place. This management system, one that is flexible and adaptable, has met a campus need and been found to work. Technological change has been made to work for individuals to enhance the instructional process.

The concept of people working together and communicating with each other has made what could have been a difficult situation into one that has created a sense of pride in the WITI-New Richmond campus staff and student body. The Apple Orchard at WITI-New Richmond is a reality and meeting inter-disciplinary campus instructional needs.

Related Readings

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MICROCOMPUTERS AND SPECIAL EDUCATION STUDENTS

INTRODUCTION

The Microcomputer Potential

Microcomputers can serve a multitude of needs in the education of handicapped students. They can assist students in acquiring basic skills and information and in accomplishing the ordinary tasks required in a job situation. They can provide individualized instruction and increase the motivation level and self-esteem of discouraged learners. Further, as they use microcomputers to accomplish specific tasks in school, students develop the computer literacy skills so critical in our technologically-oriented society. Finally, microcomputers can help classroom teachers with management, recordkeeping, and reporting tasks and enable them to have more time to instruct and assist students. These examples are not intended to be exhaustive, but merely to provide a starting point for vocational educators who work with special education students.

Microcomputer Software

Software determines how a microcomputer will be used and how effective that use will be. Software can be categorized according to general types of applications. Although these categories are not exclusive, they provide a useful framework for discussing potential microcomputer applications.

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Computer-Assisted Instruction (CAI) or courseware refers to software designed to teach or instruct particular skills such as mathematics, spelling, or typing. CAI can present basic skills or specific vocational skills to students. The instructional mode may be tutorial, drill-and-practice, or simulation.

Another type of software is solution-oriented. The program helps the user accomplish a task more efficiently such as to produce a document, store and process information, develop an individualized education program (IEP), or even create a CAI lesson. Software in this group includes word processing, database management systems, electronic spreadsheets, and courseware authoring systems. Computer managed instruction (CMI) software such as teacher grade books, curriculum development systems, and other class management programs are also included.

A third category of software important to vocational educators and handicapped students are those programs which convert a microcomputer to a brailler or a communications tool. This software may be considered an assistive device or prosthesis because it specifically helps handicapped students overcome the disabling effects of a sensory, mental, or motor impairment.

One software program can serve a variety of needs. For example, although word processing training can offer students a useful vocational skill, this software can also help students develop language skills, acquire a useful life skill and communication tool, and concurrently develop computer literacy skills.

Microcomputers in Vocational Education

Many microcomputer applications hold promise in the education of handicapped children. The specific topics to be discussed in this chapter are computer literacy, LOGO, basic skills, word processing, vocational skills, assistive devices, and classroom management. Each of these applications can be extended to vocational education programs serving special needs students.

COMPUTER LITERACY

Because microcomputers can help mildly, severely and profoundly handicapped students perform many learning and work-related tasks that previously may have been impossible or at least very difficult, computer skills can improve the overall quality of life of the handicapped. Helping students become computer literate is an essential microcomputer application for the vocational education classroom. It is therefore crucial to understand the dimensions of the term "computer literacy."

Introducing Microcomputers

The first step in acquiring computer literacy is becoming comfortable at the terminal, knowing how to turn the computer on and off, using the keyboard, and loading and removing programs on diskette or cassette tape. Students can learn to copy programs, use a few BASIC commands such as LOAD, RUN, and CATALOG, and operate a printer or modem. Initial training should include a few games and other easy-to-use applications software. Each microcomputer comes with a manual which explains more than enough to get started. Many third party producers have developed print, audiocassette, diskette, and videocassette materials designed to acquaint students and adults with the basics of operating a computer. One example is How to Operate the Apple II Plus: An Audio Cassette Mini-Course (Note 1), a set of cassettes which walks the beginner through the fundamentals.

Perhaps the most important component of the initial literacy training is information about what computers can and cannot do. Students and teachers both may have misconceptions that need to be corrected as well as horizons to expand. With a little computer experience, students will be able to use a microcomputer for basic skill development. CAI programs vary widely in quality and ease of use; however, in general, they do not require students to know the BASIC programming language.

Applications Software

For most people in the work force, computer literacy means being able to use specific software programs such as word processing, database management, an electronic spreadsheet, an accounting program, an inventory program, etc. To use these programs, students will require more than training on the operation of a computer; they must have fundamental skills and knowledge of the specific area in which they will use the program. In a job situation, computer literacy means entering, retrieving, and interpreting data correctly. Word processing workers must know how to type, spell, edit, and proofread in addition to being able to use a particular computer and software.

Programming a Computer

Another aspect of computer literacy is being able to control the computer by learning its language--learning to write the instructions that the computer follows. Because BASIC is the language built into microcomputers, many students begin by learning that language. Students also can use microcomputers to learn other common programming languages such as FORTRAN, COBOL, Pascal, and LOGO. Although learning enough about BASIC to write some simple programs is rather easy, becoming an expert programmer takes effort, motivation, and time.

Benefits from Programming

Learning how to program a computer at an expert level clearly provides an individual with a vocational skill. Other benefits, however, can be derived, such as developing problem solving, logical thinking, and mathematics skills. The LOGO language, in particular, has been widely recommended for use with handicapped students.

LOGO: A SPECIAL COMPUTER LANGUAGE

LOGO, a computer language designed especially for education by Seymour Papert and his associates at the Massachusetts Insitutute of Technology (MIT), is structured so that even preschool children can use a computer to learn mathematics, programming, and problem solving. LOGO is also a complex, powerful programming tool with applications for highly skilled programmers (Abelson, 1982; Papert, 1981).

An important difference between LOGO and most other languages is that students can define commands and create their own language. They "teach" the LOGO turtle (a small triangle on the screen), by providing it with simple or complex instructions. The turtle will move any given number of spaces on the screen and will turn at any angle. Students tell the turtle the moves necessary to draw a square, a house, or other object. Then they can command the turtle to "SQUARE" or "HOUSE" and the turtle obeys. Complex drawings can be developed through a process of estimation, experience, and revision. Using LOGO, students determine the problem to be solved, make choices, and build on what they learn. This aspect of LOGO is called turtle graphics; there are also list processing commands that can open a realm of interactive language arts programs.

The Terrapin Turtle Robot

Because using the keyboard is difficult or impossible for severely handicapped students, other methods of using LOGO such as the Terrapin Turtle Robot have been developed. The turtle robot looks like a clear, inverted bowl on two wheels. It is attached to a long cord going back to the computer. The turtle robot draws shapes on large pieces of paper on the floor. To send LOGO commands to the turtle, individuals push large buttons or use other easy to manipulate devices.

LOGO and Handicapped Children

The MIT LOGO group has worked with many physically disabled, autistic, emotionally disturbed, and dyslexic children and has developed case studies demonstrating their improvement in academic and social development (Weir, Russell, & Valente, 1982). Teachers also have found that LOGO helps slow learners gain self-confidence in their approach to problem-solving (Muller, 1982b). At the Cotting School for Handicapped Children in Boston, severely and profoundly handicapped students have been helped to learn writing, mathematics, and programming using LOGO (More on Logo, 1982). The success of LOGO in teaching programming and developing other basic and vocational skills has been widely reported in the literature (D'Angelo, 1982; Euchner, 1982; Grady, 1982; Hancock, 1983; Watt, D., 1982; Watt, M., 1982).

LOGO is available on diskette for Apple computers from Krell Software, Terrapin, Inc., and Apple Computer (Note 2) and for the TI 99/4 from Texas Instruments (Note 3). Reviews of these versions of LOGO have recently appeared in a number of periodicals (Adams, 1982; Muller, 1982a; Peterson, 1983).

TEACHING BASIC SKILLS WITH MICROCOMPUTERS

Microcomputer courseware (CAI) can be an effective tool for teaching or drilling the basic skills required in a vocational classroom. Although mathematics, reading, and language arts packages are most abundant, teachers will also find useful CAI materials to teach typing, measurement, and other specific skills required in various occupations. Appendix A lists several producers of courseware that special education teachers have found useful. Courseware evaluation guidelines and assistance in locating materials are available from MicroSIFT and EPIE (Note 4).

Research Findings

In a comprehensive review of the research literature, evidence indicated that students learn more, retain more, or learn the same amount faster using computers; further, they enjoyed learning more (Bracey, 1982). Reports show that microcomputers have been used successfully with students with many types of handicaps in a variety of situations. Educationally handicapped students, for example, improved their ability to decode language (Spring & Perry, 1981-1982). In another study, the spelling problems of learning-handicapped students were remedied (Hasselbring, 1982). Profoundly mentally retarded children improved their ability to use language and acquired positive social behavior in a program involving word processing software and a microcomputer (Thomas, 1981). In another study, hyperactive children were able to work longer at a task with the help of specially designed microcomputer software (Kleiman, Humphrey, & Lindsey, 1981).

WORD PROCESSING

In business, small and large computer systems have been used for word processing for many years. Usually, the computer is a "dedicated system," which means that the computer was designed specifically for word processing and probably is not used for any other applications. Word processing software also is available for the all-purpose microcomputer such as the Apple, Atari, TRS-80, PET, and TI 99/4. These word processing programs range from easy-to-use, inexpensive, and unsophisticated to powerful, complex, and costly. Between those two extremes are many programs from which to choose. A comprehensive review of word processing programs for microcomputers and glossary of terms appeared in the December issue of Interface Age (Heinz, 1982).

Word processing skills are clearly important in vocational education; however, a microcomputer and a word processing program can also make life easier for anyone, including teachers. Any document (tests, quizzes, letters, reports, work sheets) can be typed, edited, saved for future use, and printed in single or multiple copies. Each worksheet or test can be individualized for a student. Instead of acquiring a huge file of materials, teachers can maintain a file of diskettes in a small box or notebook.

Teaching Language with Word Processing

Word processing software and microcomputers also have been used to teach students language and composition skills. At the National Technical Institute for the Deaf, for example, a program titled Magic Window (Note 5) was used successfully with hearing impaired students (Miller, 1982). Other educators have reported improvement with students from elementary to high school and have pointed out how the ease of revising with word processing software motivates students to produce error-free compositions (Beechfold, 1982; Dauite, 1982).

THE MICROCOMPUTER AS AN ASSISTIVE DEVICE

In addition to courseware and solution-oriented software packages, microcomputers can be used in a variety of ways as assistive devices or communication tools by handicapped individuals. For example, brailler/text editors allow teachers of blind students to quickly produce braille copies of any printed materials (McConnell, 1982; Note 6). Microcomputers with special software and speech synthesizers have helped many non-verbal handicapped people to communicate (Baker, 1982; Demasco & Foulds, 1982). For additional information or specific assistance in locating adaptive software or hardware, educators should contact the Trace Center (Note 7) or the Prentke-Romich Company (Note 8).

Other Assistance for Students and Teachers

Special assistive software also has been designed to help teachers of handicapped students. For example, a program was designed to aid teachers in teaching lip-reading to hearing impaired students (Hight, 1982). Other courseware, which has been designed for general populations, has been found to be helpful for students with learning disabilities, and emotional or speech disorders. A major concern of special educators always has been the difficulty in getting and holding the attention of these students. A microcomputer used in day-to-day instruction can greatly increase these students' attention spans. Large color graphics are attention-getters and are beneficial to students with impaired vision. Programs that provide instant feedback and that personalize the lesson by naming the student also help to sustain attention. The unlimited amount of repetition that computerized lessons can offer is yet another advantage (Sicoli, 1982).

ASSISTANCE FOR THE TEACHER

When a school purchases software, at least some of the money should be spent on programs to help the teacher with class management, recordkeeping, reporting, and instructional development. With microcomputers, teachers can quickly take care of chores that were previously time-consuming. In many cases, a microcomputer allows a teacher to do things that may have been left undone due to lack of time. For example, programs that rapidly analyze the readability of text using several formulas such as Spache, Dale-Chall, and others are available. Software can create word search and crossword puzzles from lists of words typed into the computer. Grade-book programs can store records for several classes, alphabetize lists, compute statistics, and print reports. Computerized systems such as the Super-Planner from Learning Tools, Inc. have been designed for the needs of special educators in individualized instructional planning and reporting (Note 9). In addition, word processing programs, career guidance systems, and many other solution-oriented software packages can make teaching easier as well as more efficient and effective.

SUMMARY

The vocational applications of microcomputers for special education students presented in this paper have barely scratched the surface. An analysis report of applications of microcomputers in vocational education and an annotated listing of periodicals containing items of interest to vocational educators who use microcomputers are available from the National Center for Research in Vocational Education (Note 10).

To review, some of the major uses of microcomputers which can be explored by vocational educators are:

- To promote technological and computer literacy
- To improve basic skills

- To develop skills for daily living
- To develop vocational skills
- To assist teachers in the classroom.

REFERENCE NOTES

1. How to operate the Apple II Plus. FlipTrack Training Tapes, Box 711, Glen Ellyn, IL 60137. Telephone 312/790-1117.

2. Krell LOGO. Krell Software Corporation, 1320 Stony Brook Road, Stony Brook, NY 11790. Telephone 516/751-5319 ($149.95). Terrapin LOGO, MIT. Terrapin, Inc., 380C Green Street, Cambridge, MA 02139 ($149.95). Apple LOGO. Apple Computer Company, 10260 Brandley Drive, Cupertino, CA 95014 ($175.00).

3. TI LOGO. Texas Instruments, Inc., PO Box 53, Lubbock, TX 79408 ($129.95).

4. MicroSIFT. Northwest Regional Educational Laboratory, 300 SW Sixth Avenue, Portland, OR 97204. Telephone 503/248-6800. EPIE Institute, PO Box 620, Stony Brook, NY 11790. Telephone 516/246-8664.

5. Magic Window. Artsci, Inc., 10432 Burbank Boulevard, N. Hollywood, CA 91601 ($100.00; for Apple II and II Plus, DOS 3.3.).

6. Raised Dot Computing, 310 South 7th Street, Lewisburg, PA 17837. Telephone 717/523-6739. (Brailler/Text editor for Apple II; $250.00.)

7. Trace Research and Development Center, University of Wisconsin-Madison, 1500 Highland Avenue, Madison, WI 53706. Telephone 608/262-6966.

8. Prentke Romich Company, 613 Township Road, Shreve, OH 44676. Telephone 216/567-2906.

9. SuperPlanner. Learning Tools Inc., 686 Massachusetts Avenue, Cambridge, MA 02139. Telephone 216/864-8086.

10. National Center for Research in Vocational Education, 1960 Kenny Road, Columbus, OH 43210. Telephone 800/833-4707.

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APPENDIX A

SELECTED SOURCES OF COURSEWARE SUITABLE FOR SPECIAL EDUCATION STUDENTS

BARTLEY SOFTWARE 3268 Coach Lane #2A Kentwood, MI 49508	Courseware that teaches letter recognition, word families, arithmetic and verbal skills, and clock-telling time with large character screen displays.
CALIFORNIA SCHOOL FOR THE DEAF 39350 Gallaudet Drive Fremont, CA 94538 Telephone: 415/794-3687	Public domain courseware developed by teams of teachers and programmers for Apple II computers; also, BLOCKS, a courseware development system for teachers.
DEVELOPMENTAL LEARNING MATERIALS One Elm Park PO Box 4000 Allen, TX 75002 Telephone: 800/527-4747	Producers of the Arcademic Skill Builders series for Apple computers, mathematics drills in game format designed for keyboard or paddle input. Programs can be set at very easy to challenging levels.
EDUCATIONAL ACTIVITIES, INC. PO Box 392 Freeport, NY 11520 Telephone: 800/645-3739	Courseware for major microcomputer systems in most academic areas. A set of math materials designed by a special education teacher for slow learners and learning disabled students is available.
EDUCATIONAL RESEARCH, INC. 44 N. Last Chance Gulch Helena, MT 58601 Telephone: 406/443-3600	Producers of educational software for handicapped children including topics such as concept formation and others.
EDU-WARE SERVICES, INC. PO Box 22222 Agoura, CA 91301 Telephone: 213/706-0661	Producers of mathematics, algebra, visual discrimination, perception, and other programs for Apple and Atari microcomputers.
IDEATECH COMPANY Box 62451 Sunnyvale, CA 94088 Telephone: 408/985-7591	Educational software for learning-disabled and mentally handicapped students for an Apple computer. Titles include: Basic Electricity, Color Guess, Mathpack-1, and Languagepack-1.
MCE, INTERPRETIVE EDUCATION, INC. Mall Plaza, Suite 250 1575 S. Kalamazoo, MI 49007 Telephone: 616/345-8681	Producers of vocational education and career development software for apple computers.
MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM (MECC) 2520 Broadway Drive Saint Paul, MN 55113 Telephone: 612/376-1105	Educator-developed courseware for Apple and Atari microcomputers; most subject and age groups; computer literacy, vocational education, and class management software.
SOFTSWAP/CUE San Mateo County Office of Education 333 Main Street Redwood city, CA 94063 Telephone: 415/363-5472	Public domain courseware developed by educators for major microcomputer systems in many subject areas and skill levels.

MICROCOMPUTERS FOR THE HANDICAPPED

by

Sam L. Jenkins

If anyone is going to benefit from computer technology, the handicapped will. Indeed, computer capabilities which are merely interesting or unusual to the general public may be esstential for the handicapped. A computer which will scan a page in a book and pronounce each word is a mere curiosity unless you are blind. The potential for using small microcomputers or home computers for the handicapped is just beginning to be realized. With the dramatic drop in prices of the computers and their concurrent increase in capability, sophisticated solutions are possible for some of the chronic problems faced by handicapped individuals.

In the general hubbub of computerization in education, most people fit between two polar views. On the advocate side of computerization in education is the individual who supports computers because they like gadgets and personally enjoy the break in the routine that new technology provides. The closets of institutions are full of interesting but ineffective audiovisual equipment which have had a brief period of popularity. At the other end of the scale is the individual who has trouble accepting even electric typewriters or anything else that smacks of new technology. Both these extremes represent danger to the intelligent implementation of computers for special education students. More specifically, in the area of special needs students, there is a risk of ignoring the computer technology until a prescriptive label is placed on the computers and software. Some will wait until the equipment and the software comes with the appropriate LD or MH label to insure that the programs are "safe" to use. Others may wish to use any off-the-shelf programs without proper consideration given to the special learning problems of the handicapped student. Of course, intelligent moderation is required to implement computer based education. But, you may ask, why is the computer any more effective than other more tried and tested methods of instruction? What can a computer do better?

Your answer depends upon which of the above positions are responding to the question. There is no simple, totally verifiable answer to these questions.

But a most persuasive argument can be made for the basic concept of INTERACTIVE program techniques. Imagine you have a filmstrip and aduio tape which explains the basic parts of a bicycle. The student can only watch the film as it advances automatically through the preset sequence. The student or a teacher may manually press the pause or stop button on the filmstrip projector to ask questions and stimulate discussion, but otherwise, the student progresses through the exercise in a linear fashion. Contrast that with the computer assisted instruction technique. The student can observe diagrams and charts on the screen or a work book. Questions about the material can be presented upon the video screen. The computer may even "speak" and ask the student questions verbally. The computer can evaluate the student's responses as he presses keys, points a light pen to the correct place on the screen, guides joysticks, etc. If the response is evaluated as "correct" the computer can continue with the next segment of information. If however, an error is detected, the computer program can branch to remedial instruction or helpful prompts to help clear up the missunderstanding. This is an INTERACTIVE program technique where the student actually influences the lesson content and order of presentation. The student can control the pace of the lesson, and to a certain extent, the content. Feedback can be immediate. Learning can be reinforced instantly, and of course the computer has "infinite patience." Notice that the effectiveness of the computer still rests upon the appropriateness and accuracy of the lesson content. Instructional design is critical. The computer must not become a mere gimmick. If the computer is used merely as an electronic page turner it will prove to be an expensive gimmick which has no distinct advantage over the traditional tools of education. It is for this reason that special education professionals from the schools, sheltered workshops, professional associations, and parents of the special child, must be involved the the development of software for the handicapped.

Public Law 94-142 sets up certain requirements for the education of handicapped youngsters. The most dramatic requirement is that the handicapped child be educated in the "least restrictive environment." This means that wherever possible the physical or mentally handicapped student should be educated in the same location as "normal" peers. Due to the legislative requirements the schools have attempted to locate and utilize all the assistance available to overcome the physical and curricula barriers to mainstreaming of the handicapped.

Rehabilitation agencies and Centers providing services for the Developmentally Disabled are attempting to provide the maximum training possible so that handicapped citizens may achieve a degree of independence. In some cases, vocational placement is the goal while in others, improved functioning in an institutional or home setting is the most that could be achieved.

Individuals who cannot leave their home due to the severity of their disabilities often benefit from aids and appliances which can help them function independently or with minimal care. Often, a handicapped person who would otherwise be unemployable in a competitive job can work effectively if appropriate modification is made to the work station.

Employers, educators, parents, and the handicapped can all benefit from the powerful yet low cost microcomputer technology available today. The ways that microcomputers can be used in the environments mentioned above include: 1) Sensory, motor control, and communications compensation, 2) Environmental control, and 3) Computer Assisted Instruction.

Compensation may be in the area of sensory deficits (visually or hearing impaired), communication problems, or psychomotor problems. Divices to help the sensory impaired e.g., inner ear implants, hearing aides, Kurzweil Reading machines, laser and sonar canes, have received the most notice but recently microcomputers have been used to stimulate the muscles of paralyzed patients to achieve microcomputer controlled walking. Further out on the research and development frontier, work is proceeding on Visual Cortex implants which will permit a blind patient to recognize visual patterns developed by sensors implanted directly into the brain. Communications compensation focuses on overcoming deficits due to the inability to speak. Speech synthesizers and speech recognition units can provide communications channels for these individuals.

Environmental control and management tasks range from mundane word processing for written communication to more exotic remotely accuated switching of lights, appliances, and telephones. Many handicapped, homebound individuals have achieved independence by automating various ordinary household tasks such as locking and unlocking doors, adjusting the heat or air conditioning, using the stove or other appliances. In these appliances the microcomputer can be considered a prosthesis replacing impaired or deficient human abilities.

It is in the area of Computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI) that the low cost microcomputer is finding dramatic application. The education system of the United States from pre-school to post graduate levels is being challenged as never before. A crisis is developing with respect to appropriate use of the computer. Some critics claim that the computer will widen the gap between the poor and well-to-do neighborhoods while others prognosticate the eminent demise of the computer and a return to the good old days! Most educators recognize that our society is making a change into a techno-informational based economy and the computer must be recognized as a tool in that society. Editorilizing aside, the computer can be used to provide instructional material in the following formats:

1) Drill and practice where previously learned information is rehearsed or practiced to obtain mastery.
2) Tutoring (or tutorial) where new material is learned in small increments appropriate to the learning speed and style of the learner.
3) Simulations where a system is modeled and the student effects the model and its outcomes by inputing information or modifying the existing structure of the model.
4) Problem solving where the student is required to interact with a situation which leads them through the process of solving a problem.
5) Gaming where an element of competition is introduced between the student and the computer program. This is usually done in a game like sequence where the competition is fun and stimulating

The most common form of CAI has been Drill and Practice because it is the least complicated to design and program. As microcomputers increase internal memory sizes, larger and more complicated programs are possible. New color graphics and speech capabilities of microcomputers further improve the power and richness of programs. The general advantages of CAI over traditional instructional methods are INDIVIDUALIZATION of lesson content and presentation speed. Each student may receive a "custom" designed lesson based on the computer's analysis of his response rate and quality. By analysing the student's answers the computer program may branch to remedial or advanced material. A cleverly written computer program can be MOTIVATIONAL and interesting. The program can present colorful animated graphics and produce speech so that the student's attention is focused on relevant cues and distractions are minimized. The student can quickly experience success and reinforcement from the program. (S)he can control his/her own learning environment to a certain extent. This sense of control over one's learning can be a powerful motivator. Immediate reinforcement for correct responses and gentle corrections for mistakes give the learner confidence as he progresses through the lesson segments. The student need not suffer the embarrassment of failure before teachers and friends. For the handicapped learner this is doubley important.

Computer Managed Instruction (CMI) provides effective management of lesson assignment, evaluation, and prescriptive instruction. A student's progress can be documented with accurate record keeping. Individual education plans can be prescribed and documented by the teacher. This is extremely important in today's crowded classrooms where the handicapped individual may have to vie for attention.

Some problems exist in effective use of microcomputers. In general, there is a lack of awareness of the availability of computer hardware and software. On the one hand, some may believe that software programs must be specifically designed for a particular handicap before it can be useful. The person holding this view will overlook a large body of software which can easily be adapted for use by and for the handicapped. On the other hand, special education students often do need specially designed software. The author has found that what is inadequate in a software package is usually not due to special needs of the handicapped but is due to poor educational design in general. The most glaring example of this is the program which purports to teach the ABC's but requires the student to recognize complete words and sentences in order to use the program. Such design flaws in software disqualify it for use by normal as well as handicapped learners. In the January 1983 issue of the EDUCATION DEALER magazine, an article written to encourage dealers to inventory and sell computer software for special education, could only find 13 companies producing computer software designed or adaptable for the special education market. (See references for this list). Another important problem is the need for training America's teachers and rehabilitation professionals in computer concepts and techniques. The average professional is struggling to keep up with a miasma of paper work and administrative demands as well as crowded classrooms. Spending the time and effort to learn a new skill in computing is often more than one can face. The computer has introduced unique demands on professional time and skill. Whereas in the past the professional could develop a functional skill with a new teaching devise (e.g., a filmstrip projector) merely be reading the manual and finding out how to turn it on and insert the media material, mastery of the computer as a teaching tool demands a broad understanding of the history and terminology of computers, programming languages and operating systems. Help may be around the corner as computers grow more "user friendly" and less "techno-babble" is used.

The problem of awareness is a serious one. Those unfamiliar with the capabilities of the microcomputer often have little or no understanding of the computer's features and limitations. The author frequently demonstrates educational software which uses animated color graphics and synthesized speech. During these demonstrations, it is common for someone who has just observed animated ducks on the computer monitor to ask "can it do turtles?" This question suggests that the questioner mistook the programmers creative imagination for something built into the computer. They apparently think that the computer can automatically create ducks. Once the beginner is introduced to the actual process of creating such animations they quickly realize that the answer to "can it do turtles" is answered, "yes, if you can program it to turn dots on off on the minitor to look like a turtle." Another way of describing this confusion is analogous to a foreign language student asking of his French Professor, "can the French language describe a sunset?" The point is that the computer and the languages used to program it are only as powerful as the person using the machine to create the educational material.

You may realize that some computers will have special features which make them more suitable for certain types of programming than others. The second part of gaining useful awareness about computers is being able to evaluate different brands for their unique features so that appropriate equipment is selected. The following is a partial list of the features which are advantageous to have for computer assisted instruction for the handicapped.

1) Color graphics capabilities. Color graphics can be extremely effective in presenting information visually to the student. For those with poor verbal skills, the graph, chart, or color animation may illustrate a concept. One picture is indeed worth many words. It is extremely important that the graphics be simple to use so that the novice programmer can easily work with the computer and use the graphics capabilities without having to develop advanced programming skills. The computer should have the ability to present graphics and words on the same screen at the same time. Some popular computers cannot do this without special programming techniques. The graphics resolution must be sufficiently detailed to present clearly identifiable objects. Just a year ago programmers were attempting to represent animals, etc. with "stick" drawings. Today this would not pass. Today's modern microcomputer and software can generate drawings of striking detail. For lively, interesting, animations the capacity to generate graphic characters called Sprites is important. Sprites are graphic characters which can be made to look like any character on the keyboard or can be defined by the programmer to look like anything desired. These objects can be manipulated by the computer so they float around on the screen, collide, change shape, emit sound, and generally create high quality graphics which are difficult to do without sprites.

2) Sound generation for the creation of music. Sound can be used to generate beeps for simple feedback to the student. Such audio feedback can be used to indicate when a key has been pressed correctly, etc. More importantly, sound generators in the computer can be programmed to play musical scores providing a striking and interesting auditory reward for the student. The sound capabilities of the computer should be easily programmed from BASIC and not require any special programming skills.

3) Speech synthesizer. Synthesized speech output may be required to substitute for printed instructions for those who cannot read either due to visual limitations for intellectual impairment. If the computer can be programmed to talk to the student it seems more personal and easier to use.

Speech input to the computer can substitute for entering information from the keyboard helping those who may be physically unable to press the keys.

4) Large character set for video monitor display. Educational programs benefit not only from colorful animations but also require large easy to read printed characters. Many microcomputers can put 80 characters on each line of the video display which is good for data and word processing. It reduces the size of each character, however. It is better to have the capability of generating and displaying characters 2 or 3 inches on a side for educational programming. It is especially advantageous if the character set can be displayed using the Sprite graphics so that every character in the alphabet can be used as a separate (and large) animated character.

5) Easily programmed by the user. Few people are going to learn programming sufficiently well to develop their own educational software. But it is important that someone is available as a resource person to modify software for the special needs group. This may be someone in the educational system who shows a special interest in programming and who can develop the skills necessary for basic program modification. If the computer is easy enough to use and the programming language simple enough to understand, even the nonprogrammer may be able to learn how to do simple modifications to the program. The ideal situation is to have a computer which is extremely easy to program, yet has a powerful set of BASIC programming commands which can be manipulated to achieve the special effects of integrated animated color graphics, sound, and synthesized speech.

6) Large body of basic skills software which can be adapted to special needs groups.

7) Easy to use keyboard.

8) Special devices for input such as joysticks, lightpen, and graphics tablet.

9) Other features include: Tape recorder or disk drives for data and program storage. The disk drive is faster and more reliable but cost about 10 times as much. A printer for hardcopy of records is also desirable. A simple, low cost, dot matrix printer will be adequate for this purpose.

PUBLICATIONS AND DIRECTORIES

BYTE: THE SMALL SYSTEMS JOURNAL
P.O. Box 328
Hancock, NH 03449
(September 1982 more than a half dozen articles about computers and the disabled.)

THE CATALYST, WESTERN CENTER FOR MICROCOMPUTERS IN SPECIAL EDUCATION, INC.
Suite 275
1259 El Camino Real
Menlo Park, CA 94025
415-326-6997
Bimonthly; $12/yr for individuals, $20/yr for companies and agencies; complimentary copies sent upon request.
Newsletter that covers the spectrum of special ed/microcomputer topics, including software, hardware and pertinent regulations.

CLOSING THE GAP
Route 2, Box 39
Henderson, MN 65044
612-665-6573
Bimonthly; $15/yr, single copies $3.00
Newspaper that provides information about microcomputer programs and devices that help handicapped individuals "close the gap" between themselves and the rest of society.

MICRO MARKETS EXAMINER
Kathy Hurley
Morgan Point Press
P.O. Box 411
Eureka Springs, AR 72632
501-253-8053
Ten Issues/year, $74.00.
Specifically for dealers and software producers, this newsletter includes information about microcomputers and special education in every issue.
Other features: marketing column, Washington report (federal funding, etc.), new peripherals and their impact.

PERSONAL COMPUTERS FOR THE PHYSICALLY DISABLED
A RESOURCE GUIDE
Apple Computer, Inc.
M/S 9H
10260 Bandley Dr.
Cupertino, CA 95014
408-996-1010
Free upon request, this booklet describes microcomputer applications for the handicapped and lists contacts for each program, device, publication or service discussed.

TRACE CENTER INTERNATIONAL SOFTWARE HARDWARE REGISTRY
University of Wisconsin-Madison
$15.00 plus $1.50 for shipping
A comprehensive, descriptive listing of software, hardware and adapters as well as miscellaneous tips and application notes regarding the use of computers with handicapped individuals.

PRODUCERS OF SOFTWARE, DEDICATED HARDWARE AND ADAPTIVE DEVICES

Although many of the following organizations specialize in microcomputer products for the handicapped, others (such as Texas Instruments) are listed because their products are widely used in special education although they were not specifically designed for this field.

BLS, INC.
2503 Fairlee Rd.
Wilmington, DE 19810
302-478-4063
Request software catalog.

CENTURION INDUSTRIES, INC.
167 Constitution Dr.
Menlo Park, CA 94025
415-321-0800
Request catalog of dedicated educational computers and compatible software.

DEVELOPMENTAL LEARNING MATERIALS (DLM)
1 DLM Park
Allen, TX 75002
214-727-3346
Request software catalog from vice president of marketing.

HARTLEY COURSEWARE, INC.
P.O. Box 431
Dimondale, MI 48821
616-942-8987
Contact Rosie Bogo. Request software catalog.

MICRO-COMPUTER EDUCATIONAL PROGRAMS (MCE) INC.
157 S. Kalamazoo Mall
Kalamazoo, MI 49007
616-345-8681
Contact Allen Kemmerer
Request dealer kit, which includes software catalog.

MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM (MECC)
2520 Broadway Dr.
St. Paul, MN 55113
612-376-1118
Request software catalog.

SOUTHERN MICROSYSTEMS FOR EDUCATORS
P.O. Box 1981
Burlington, NC 27215
919-226-7610
Request catalog of software for special education administrators.

TEACHING TOOLS: MICROCOMPUTER SERVICES
P.O. Box 50065
Palo Alto, CA 94303
415-493-3477
Request software catalog and information about the use of computers in special education.

TEXAS INSTRUMENTS (TI), INC.
P.O. Box 10508
M/S 5890
Lubbock, TX 79408
800-858-4565
Request catalog of software and adaptive devices. Contact Mary Fesler 415-392-5700 for information about TI software and special education.

THE UPPER ROOM MICROCOMPUTER CONSULTANTS
907 6th Ave. East
Menomonie, WI 54751
715-235-5775
Contact Sam or Cindy Jenkins to request software catalog and information about special education and computers.

THE HANDICAPPED'S SOURCE a division of INTELLIGENT CONSUMER ELECTRONICS
526 Langfield
Northville, MI 58167
313-348-2793
Contact for catalog of software, hardware devices, books for the handicapped.

ZYGO INDUSTRIES, INC.
P.O. Box 1008
Portland, OR 97207-1008
503-297-1724
Request catalog of communication systems and assistive devices.

THE OFFICE--TODAY AND TOMORROW

Opportunities for Vocational/Technical and Career Education

by

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Before contemplating the office of the future, one needs to reflect on the office of today. What is the purpose of the office of today? Will that purpose change in the future? The purpose of the office today and since its existence has been to process, generate, and move information (text, data, image, and voice). The office is responsible for servicing the total organization. In the future, the function of the office will not change dramatically but rather the way in which that function is performed will change. Through the utilization of advances in technology, procedures whereby information is processed, generated, and moved will be modified. The quantity, quality, and type of information generated may change, and the speed with which that information is generated will change.

Historians are referring to the present period of U.S. development as the Information Age. Where land and capital signified power in the Agriculture and Industrial Ages respectively, information is power in the Information Age. Management in business realizes the importance of information as a corporate resource and the need to manage information if quality and timely information is to be generated. Thus, managers are beginning to support the introduction of electronic information tools and procedures to foster the generation of quality and timely information. Vocational/technical and career educators need to keep abreast of developments in the Information Age if they are to prepare individuals to work in business today and tomorrow.

Status of the Office of Today

The handling of information in the office of today involves six phases: capture, creation, manipulation, distribution, storage, and retrieval. Six technologically-based subsystems have been developed to expedite the processing of information in each of these phases. The technologically-based subsystems include word processing, data processing, micrographics, reprographics, distribution, and retrieval. These technologically-based subsystems are made possible through the advent of the microprocessor. The microprocessor, a tiny silicon chip, which processes information, made the development of the microcomputer possible. The microcomputer, having a microprocessor as its central processing unit, is one of the information tools having the greatest impact on the office in the 80s. A variety of other automated tools have also resulted with the advent of the microprocessor. These automated tools include dictation equipment, word processors, microcomputers, intelligent printers, intelligent copiers, and facsimile machines.

Generation of Information Using Microprocessor-Based Tools

Information is captured in some offices today by electronic dictation equipment that is microprocessor based. Through the use of word processors or microcomputers, text and data are created on magnetic media. This information can then be altered as needed. Software programs allow the microcomputer operator to perform calculations on data and integrate this data with text. The data can be displayed as figures or in a form of graphics, using a graphics software package. Microcomputers are then used to distribute the data and text through an electronic mail system. Data and text can be stored on magnetic media (such as floppy and hard disks used in microcomputers). On demand, the data and text can be retrieved, displayed on a CRT (cathode ray tube), duplicated onto a disk, and/or a hard (paper) copy generated. The intelligent printer is driven by the microcomputer and thus can perform many printing functions without human intervention. Intelligent copiers in use today can then be used to generate multiple copies. The intelligent copy machine, comprised of a microprocessor used for self-diagnosis and control, can be programmed to do complex copying and collating jobs.

Through the technology of micrographics, data and text can be photographically reduced to a microform medium, used to record images that are greatly reduced in size in comparison with the original document, and stored. Types of microform in use include microfilm, aperture cards, and microfiche. One sheet of microfiche, a type of microform usually measuring 105 mm x 148 mm (4x6 inches) on which a group of images is arranged in rows and columns, can be used to store up to 270 data frames. Microforms can be generated directly from the computer by having data produced directly on film by a recorder from computer-generated electrical signals.

Moving into the Office of Tomorrow

However, not all businesses have these information tools at their disposal today. Nor do businesses have business information systems in place to facilitate efficient and effective use of these information tools.

Levels of information tools can be found in existence today in businesses. Chorafas (1982) challenges us to envision six levels of office automation as layers of applications, structured in a pyramid, four levels in existence in some businesses today and two levels yet to be implemented. Level 1 is the collection, storage, reporting, and distribution of data by different nonconnected devices. Information tools associated with this level include data entry equipment, electric typewriters, and copy machines of the 1970s. Electronic tools which might be found at Level 1 include dictation equipment and a mini- or microcomputer. Level 2 is the collection, storage, and reporting of text at the initial level of integration. Word processing, typesetting, and other office equipment that is microprocessor-based and compatible; i.e., capable of being integrated via a communications network, is identified with this level. Many of these information tools were introduced into the office in hopes of increasing the quantity of work generated; and, now, much of the emphasis is on generating quality work as well. Level 3 involves using communications capabilities to integrate separate processing functions. This level requires the interfacing of data processing and word processing for report generation. Also, through communications networks, electronic mail, executive calendar handling, time scheduling and other management information needs become feasible. Level 4 of office automation calls for personalized and customized office systems to support the professional activities of the employees by work station, integrating the office with the total computer resources of the business, and through these resources with voice and data networks. It is at this level that we see an integrated work station (terminal) at the disposal of the executive. An example of such a prototype is the Lisa, by Apple Computers, Inc. Level 5 involves the integration of computers and communications technology with management policy. The information tools, thus, are integrated through a communications network system designed to provide connectivity between a diverse range of tools. Procedures are developed for the use of these information tools after assessing the objectives at all levels of the organization in relation to the goals of the organization. These tools are then used to generate the information needed. Decisions are made based on the information generated in order to manage the organization and meet its overall goals and objectives. The sixth layer of the applications pyramid calls for computer-based decision-support systems,

> "enhanced through an invention of mathematical models to serve in forecasting, experimentation, simulation, graphic presentation, and allowing the user to plug in a series of givens and have the system generate the unknowns." (Chorafas, 1982, p. 22)

The first four levels are seen as being attainable by firms today. The majority of firms are estimated to be operating at Levels 1 and 2 of automation. It is at the fifth and sixth layers of the applications pyramid that the challenge presents itself. In order to integrate computers and communications technology with management policy and develop decision support systems, the ability to understand, design, and implement systems is needed. The technology and automated tools are here today. What is needed are business information systems in place which utilize the information tools. Through the use of these tools, the systems' capabilities and levels of performance can be enhanced.

Preparing For the Office of Tomorrow

As businesses embark upon moving up the pyramid in automating their offices, the preparation and planning they do will be of paramount importance.

Before investigating the information tools available, consideration of the business goals is a must. Then, through an identification of the objectives of the functional areas, departments, and/or divisions of the company, the activities necessary to achieve the objectives and thus reach the goals of the company need to be assessed. Which of these activities might be best accomplished through the use of automated tools need to be determined. Next, whether a common data base might be shared by functional areas to accomplish these activities must be assessed.

To ensure that the information generated is needed, and to be able to standardize procedures for performing the activity, a system analysis examining the work flow and delineating the procedure(s) used is necessary. Through this process, the paper generation process may be streamlined if it is determined that a given set of data or information is not needed. The procedures for generating information can be standardized, and the most efficient and effective way to generate that data might be determined.

Implications for Vocational/Technical and Career Education

Given that the office is in the midst of change with the advances taking place in technology, the very nature of the work environment is being altered. The work environment is having an impact on office personnel as each of the levels of office automation are being implemented in businesses. Changes in the procedures used to complete activities, fostered to some extent by the use of technology to perform various applications, are requiring that personnel be flexible and receptive to change. In addition, new skills and knowledge need to be acquired by all personnel in the office if an information system is to develop to meet the needs of the users. Given that the product of the office is information, a business information system needs to be put in place which will ensure that the information generated is timely, needed, and quality information.

Thus, the time is ripe for educational institutions to assess how they might best prepare individuals for the Information Age. The need exists not only to prepare students in our educational institutions but also those adults in the work force and those returning to schools who are considering re-entry into the labor force.

With the emergence of the Information Age, individuals are needed not only to work in business using the information tools generated by the new technologies, but also in industries created by the new technologies such as the microcomputer industry. In addition, individuals at all levels in business need to understand the capabilities and limitations of the tools and know how these tools can be used by them or others working for them to generate the information needed.

At the present time, a single discipline does not exist to address the preparation of individuals for positions in the office of the future; i.e., jobs within businesses related to the development and management of business information systems. Instead, businesses are proceeding by having vendors train personnel on the information tools purchased. Personnel are also being sent to the multitude of seminars being held throughout the country on topics ranging from word processing to networking and data base management, in an attempt to develop a cohesive business information system. Many firms are spending a considerable amount of money through in-house training programs.

Students continually seek advice on courses they might take to prepare them for the changing labor market. In many instances, students are being directed to courses in a variety of disciplines, including computer science, educational technology, engineering, and newly formed administrative information systems and information management departments. Thus, vocational education service areas need to continue to update their programs and curricula if they are to continue to be a viable medium for the preparation of individuals they have been serving. Approximately 60 percent of all secondary students were enrolled in federally funded vocational education secondary school classes in 1976 (Grant and Eiden, 1980). An estimate of 1.39 million students were enrolled (Grant and Eiden, 1980) in noncollegiate post secondary schools in 1976. Vocational and technical schools as well as collegiate institutions may find it advantageous to articulate in defining the scope of the Business Information Systems discipline and what the discipline might aspire to accomplish at the various levels of education.

Issues and Opportunities For Vocational/Technical and Career Education

As the jobs are changing in the handling of information and some jobs are being eliminated, given the ability to generate more information in a shorter time span with new technology such as word processors, some members of the work force are resisting these changes.

Attitudes Toward Change

Attitudes toward changes such as the introduction of the microprocessor-based technology need to be addressed in vocational/technical and career education programs and courses. Individuals must be change-oriented if they are to be satisfied working in the office of today and tomorrow. While changes have been occuring at a rapid pace, change will continue in the office environment. While the technology for the office of tomorrow is here now, people need to be ready to use and to accept the new technology.

Career Education and Counseling

Given the shortage of career counselors to assist students with the career decision-making process, the computer-based information and guidance systems now available will become more important as new career paths open up. Through the use of microcomputers in school settings, community settings and in the home, more individuals will be able to have access to career decision-making systems.

Individuals need to be knowledgeable about the type of environment they are preparing to work in to assess whether that work environment will meet their job satisfaction needs (both internal and external). While they may find the anticipated wages for the position they aspire to prepare for to be attractive, they may not be happy with the work environment. For example, when word processing was first introduced, the concept of administrative secretaries and correspondence secretaries also came into vogue. Word processing centers were formed. Correspondence secretaries (word processing operators) were housed in a word processing center. Many of these correspondence secretaries had previously been traditional secretaries. The center environment, in which they were isolated from contact with the authors of the documents they were generating, was foreign to many of them. The isolation and lack of people contact caused anxiety and often resignations among these workers. To alleviate the problems caused by the word processing center structure, many firms have since introduced decentralized structuring patterns such as satellite stations. However, the anxiety and resignations caused by the word processing centers might have been kept to a minimum. The personnel responsible for the management of the office need to have an understanding of the factors impacting on the office environment if they are to be able to forecast how changes in these factors might impact on the personnel.

Preparation for Information Managers and Users of Information Systems and Tools

Thus, vocational and technical education programs preparing individuals to manage information in business must strive to develop in students the ability to conceptualize the total business information system and to analyze the system components before making changes in the system. A system has as its components people, technology, and procedures. Considering each of these three components in designing a system and before making modifications in a system is imperative if maximum efficiency and effectiveness is to result in using the system. The ability to design new jobs with not only the technology and procedures in mind but the people as well facilitates job satisfaction and acceptance by the people. In addition, the need to redesign jobs receiving input from the people who have been performing the jobs is a must. Research studies have shown individuals will be supportive of change if they have had input into the decision-making process bringing about the change. However, if individuals are to have input into the decision-making process, they must be prepared for and capable of participating in the group decision-making process. Many individuals in positions below the mid-management level have not had the educational background to prepare them for taking an active role in the decision-making process. Many of these individuals appear reticent to make suggestions and somewhat intimidated by their supervisors. In sum, talent must be developed to manage the changing environment.

Knowledge and Skills for Users of Information Tools

Vocational and technical education courses and/or programs preparing individuals who will be using the information tools in the office must assess what skills and knowledge can be best taught on the job and the generic skills and knowledge that can be taught in the school setting and transferred to the work setting.

With many of the routine jobs being performed automatically through the use of information tools, the issue arises as to the complexity of the skills which should be taught in an educational setting. Concern arises as to whether many of the entry-level skills previously taught will no longer be necessary given that routine jobs will be automated. Thus, the emphasis being given to the levels of the cognitive domain in preparing individuals for positions in business needs to be assessed. Where the knowledge and comprehension levels of the cognitive domain may have been stressed in the past, the higher cognitive levels of application, synthesis, and evaluation may need to be developed further. For example, microcomputers might be used to facilitate an understanding of several technologies—word processing, data processing, and telecommunications. Given that word processing packages for microcomputers are not as sophisticated as those developed for word processors, the learner must develop a deeper understanding of the operation of a microcomputer to perform text processing. The knowledge and skills learned in using a microcomputer can then be transferred to a word processor for text processing. Through instruction on the microcomputer, data processing concepts can be taught as well. The integration of word and data processing for report generation can then be taught. Students can also be introduced to the development, use, and management of a data base. Through the use of data base management software, students can learn to generate financial reports for a business and discuss the use of the reports for decision-making in a firm.

While it will be important for those in our business offices to use the information tools, they need not become technicians or computer programmers. As the new technology is perfected, additional aids to simplify use of the tools are being introduced. The issue that the tools will not be used by executives unless they are easy to use is presented in many trade journals. Thus, we have seen manufacturers of these information tools attempt to design them to be easy to use and require a minimum of training. Executives and other office workers should perceive the microcomputer and other technology aids as tools to assist them in performing their functions and thus the means rather than the end. The product is information, and it is imperative the end not be lost sight of.

Another issue relates to what preparation or knowledge and skills are needed to use office automation in performing executive tasks. An issue which has arisen is whether all individuals in educational settings should be required to learn keyboarding skills in preparing for the electronic office. Executive work stations and terminals will be on the desks of the majority of business workers as we approach the 20th century, and many contend a substantial amount of time can be captured by increasing an individual's keyboarding facility. Schools may want to consider strongly offering keyboarding instruction for all students.

Role of Vocational/Technical Educators and Business in Preparing for Automation

The issue relating to what role vocational/technical education will play in preparing individuals for the automated office and what role will be played by the businesses themselves must be addressed. No doubt businesses would be pleased to have the vocational and technical institutions do more of the education and training needed if they are assured those prepared would have the knowledge and skills needed for given positions. Thus, it is imperative vocational and technical educators and their institutions work closely with businesses in developing their programs and curricula. The time lag between introduction of new technology into businesses and into the educational environment can no longer be tolerated. Through cooperative endeavors between business and industry in efforts such as cooperative education programs, the gap between business and education for business can be narrowed. In addition, sharing of resources and internships for students as well as vocational/technical and career educators can help keep those in academia abreast of the latest advances in technology and accompanying changes in systems and procedures. Business will benefit in helping to develop the abilities of students who can be productive in their environment. Vocational/technical educators will benefit in understanding the problems confronted in business and in being able to keep abreast of changes and take this information back to the classroom. Through cooperative research efforts with business, educators and business personnel can benefit to solve business problems. The possibility of sending faculty on sabbaticals to business and drawing upon the expertise of business personnel in the classroom also has merit. Barriers to such cooperative efforts need to disintegrate if vocational and technical institutions are to be able to prepare individuals for the changing office environment.

Innovative Methods of Instruction

New innovative methods of instruction will result from the introduction of microprocessor technology and the networking technology made possible through telecommunications. A greater number of students will be able to be served by vocational and technical educators. In particular, those adults gainfully employed who are interested in updating their knowledge and skill or in retraining will be able to receive instruction via a networking system in their community, at their workplace, or within their homes. In the past, adults often were inconvenienced and had to make sacrifices in order to prepare for their changing job roles. While the trend in the last decade has been for major corporations to provide in-house training programs for employees, the trend may reverse itself if vocational and technical educators take the lead, meet with business personnel to find out what type of education and training programs they perceive to be critical, and use the communications technologies available to deliver the programs. Through an increase in its market share, vocational and technical institutions will be able to afford the new information tools required for instruction.

Conclusion

In conclusion, the Information Age presents vocational/technical and career educators with an opportunity to work with businesses in preparing individuals for the changing work environment. Through cooperative efforts, vocational/technical and career educators will be able to be more thorough in their efforts to prepare individuals who can work in the changing office environment and individuals who can manage change.

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A Modular Approach to Building Adult Computing Competencies:

The DESKTOP COMPUTER SERIES

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FOREWORD

This paper describes an approach to teaching adults about computers. The program outlined is still evolving. Some segments have been completed and implemented. Student response to these has been uniformly enthusiastic.

Three basic premises underlie the overall program:

1 There is a widespread need for adult education related to desktop computers.
2 The needs are not the same for everyone.
3 To be effective, a program that addresses these needs must be flexible, pertinent and current.

INTRODUCTION

Alvin Toffler's "third wave" is sweeping the country, and the water is rising through our public education system. Microcomputers are becoming common in elementary, junior high, and high schools. Seeing the shape of the future, parents have adopted a new technology for their children. Now adults, too, must be trained in tomorrow's technologies.

Intrigued by newspaper, magazine, and television features, Americans are registering in record numbers for "computer courses." Often, these courses are designed for an audience other than the general public. Standard course lengths, semesters or quarters, have been the rule. A semester-long course in basic computer concepts may be of little use to a person trying to decide whether or not to purchase a $500 personal computer.

Formal adult education, aimed at specific jobs and careers is available. Broadbased, general, training which defines the application of new technologies is not.

Recognizing this gap in adult training, Fox Valley Technical Institute (FVTI) in Appleton, Wisconsin, is responding with a modular series of courses, designed to build a variety of computer competency levels.

FVTI maintains major education centers in Appleton and Oshkosh, the two largest cities in Wisconsin VTAE District 12. Demand for courses extends throughout the District. To satisfy the need for courses in outlying areas, FVTI offers classes at area high schools and three permanent regional centers. This course-delivery network is quite effective for teaching about microcomputers, since most high schools in the District have personal computers in their classrooms. (A fringe benefit of this approach is that many adults are learning about computers on the same equipment used by their school-aged children.)

DESKTOP COMPUTER SERIES:

A Different Approach

FVTI's modular approach to producing adult computing competencies concentrates on desktop computer training. "Desktop" is used as a generic term, representing home computers, microcomputers, personal computers, and small business computers. Extensive training programs for large mainframe computers are already available from other sources (including FVTI and other schools in the Wisconsin University and VTAE systems).

A series of short course modules was developed. Both general and specific audience interests are addressed.

The modules fall into a "natural" hierarchy. Figure 1 depicts that hierarchy. Figure 2 outlines the content and objectives of eleven course modules. (Alphabetic codes serve as a cross-reference between the two figures.)

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     FIGURE 1:  DESKTOP COMPUTER SERIES  COURSE HIERARCHY
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                      (A)
                       INTRO TO
                       DESKTOP
                       COMPUTERS
                           !
                           !
               ------------!------------------------
           (B) !      (I)  !      (J)   !    (K)    !
            BASIC I    ELECTRONIC WORD PROC-  DATA BASE
                       SPREADSHEET ESSING     MANAGER
               !
               !
         ------!------------
    (C)  !            (G)  !
     BASIC II              SYSTEMS
                           DESIGN I
         !                 !
    (D)  !            (H)  !
     FILE PROC-            SYSTEMS
      ESSING               DESIGN
         !                 WORKSHOP
     ----!-----
(E) !      (F) !
 BASIC IN   BUSINESS
   THE      APPLICA-
CLASSROOM    TIONS
```

The introductory module serves two purposes. First, many adults want to learn just a bit about computers. This course module helps to satisfy their need -- with a review of terms and concepts, a segment on the history of computers, and hands-on exposure to desktop computers. Second, for adults who require more depth, Introduction to Desktop Computers builds a solid cornerstone on which further competencies can be established.

Many adults are interested in office applications. The most common applications packages currently in use are Electronic Spreadsheets, Word Processors, and Database

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FIGURE 2: DESKTOP COMPUTER SERIES
COURSE MODULE DESCRIPTIONS

(A) Introduction to Desktop Computers
- --Overview of microcomputer development and use (Computer Assisted Instruction lesson)
- --Principles of microcomputer operation
- --Develop simple BASIC programs
- --Use VisiCalc (c) for simple problems

(B) BASIC for Desktop Computers--I
- --Introduction to program development (flowcharting, structure, etc)
- --Expand subset of BASIC instructions
- --Subroutines. Linking programs

(C) BASIC for Desktop Computers--II
- --Array processing and sorting
- --Building an application system
- --"Professional" programming fundamentals (design, documentation, production systems)

(D) File Processing in BASIC
- --Use of sequential and direct access files in BASIC programs
- --File design for microcomputer application
- --File handling and security (problems and procedures)

(E) BASIC in the Classroom
- --Techniques for teaching BASIC programming
- --Building problems and cases
- --Developing programs for classroom use
  - ...Elementary drill and practice
  - ...Classroom management

(F) Business Applications in BASIC
- --Case study development of business applications for desktop computers. (Cases may be custom fitted to specific classes.)

(G) System Design for Desktop Computers--I
- --Principles of systems design and development
- --Developing systems requirements specifications
- --Package selection techniques

(H) System Design for Desktop Computers--II
- --Workshop in design of student-defined systems

(I) Spreadsheet Applications
(J) Word Processing Applications
(K) Data Base Manager Applications
- --Demonstration and use of commercially available software packages
- --Where applicable, emphasis on student use of packages in their personal environments

Managers. Course modules provide fundamental competencies in the use of each of these "generic" packages.

Three course modules deal with BASIC program development. Student assignments in each of the modules build on previously attained levels of expertise. Because access to microcomputers outside class hours may be limited, sample solutions are always available for student use. In this way, classes progress together from one concept to the next. At the end of a course module, each student has examples of programs that embody the concepts taught.

Two Systems Design modules deal with systematic development of applications programs and specifications. The first BASIC module is prerequisite to these modules, so students will have some exposure to the tasks of program development. A workshop format is employed in the second systems class. Working together, under the guidance of an experienced instructor, students develop actual specifications for applications systems.

A workshop format is also employed in two other courses. These are aimed at specific audiences. In BASIC in the Classroom, teachers are segregated by grade level and interest area. Then they develop group projects of mutual interest and use. Business Applications is also segregated -- between people from small and large business environments.

Additional courses will be developed as needs are identified. This core of eleven course modules provides a sound base for further development.

THE DEVELOPMENT PROCESS

The basic premises stated in the Foreword established the directions for this program. Needs are broad and varied. To be effective, responses must be flexible.

More concise objectives were defined in terms of the competencies which would evolve from the course modules. All competency objectives are based on "hands-on" application of the desktop computer training.

COMPETENCY OBJECTIVES: Four general objectives were developed for the initial program. They span the entire program and reflect the general plan of addressing computing competency development needs. Planning for future competency development will be based on successful attainment of these initial objectives.

1 Understand the concepts and uses of desktop computers. Students should be able to relate to the development of computers, code a simple computer program, and use a computer to run packaged applications software. This competency is prerequisite to undertaking more advanced training.

2 Develop BASIC programs for desktop computers, using concepts such as array and file processing. All students will not require the same levels of expertise, and this training should be subdivided into multiple levels.

3 Develop the ability to apply the "systems approach" to problem solving. Students should learn to analyze a problem in terms of its logical components and then design a solution embodying the use of a desktop

computer system.

4 Use commercially available software packages efficiently and effectively. Students learn to operate specific packages, including use of reference documentation and hands-on operation of the packaged systems.

CURRICULUM DEVELOPMENT: One of the concepts underlying the modular approach was that the time frame for course modules had to be shorter than the traditional 12 or 18 week blocks. FVTI has adopted a module length of 4 weeks. Classes meet for 2-1/2 to 3 hours each week. Outside assignments account for about 2 additional hours for each student.

For scheduling, the four-week modules are fitted into five-week calendar time slots. This increases flexibility for both students and instructors. For instance, one BASIC module might end with a large student assignment, to be completed during the two weeks following the end of the module. That assignment, then, might be the starting point for the succeeding module. Seven of the five week time slots fit nicely into a traditional 36-week school year. Each teaching location establishes its own schedule for course modules.

Because the courses are taught in a variety of locations, standardization is necessary to maintain quality control and accommodate students who may participate at different sites. Comprehensive Instructor's Manuals are developed for each of the course modules. While the manuals contain enough material to cover entire courses, instructors are encouraged to use imagination and ingenuity in presenting their modules. Module objectives and target competencies are firmly stated in each of the manuals. Where they are applicable, sample computer programs and Computer Assisted Instruction (CAI) lessons are included in the manuals. Full-time staff members are available as resources for the part-time instructors who present the course modules.

Some software programs have been developed to support specific course modules. One CAI lesson deals with the history of computers. Another explains the Desktop Computer Series. BASIC programs capture and summarize student evaluations at the end of each class. Additional software will be developed as the courses go on -- including a collection of student-written programs and systems.

BUILD IN FLEXIBILITY: In adult education, flexibility is prerequisite to long-range program success. Good training modules, once implemented, must not be allowed to stagnate. The subject area, desktop computers and information processing, changes rapidly. It is imperative that course material be fluid and current.

Student feedback provides a sound basis for course revision. One measure of the effectiveness of a module is student interest, as reflected in attendance. Student comprehension and mastery provide another effectiveness measure. Since the courses are ungraded, students rate their own comprehension levels.

At the last session of each course module, students complete a 12-question course evaluation form (see Figure 3). Each response is recorded on a continuum. Using a desktop computer system, mean and modal results are calculated for each question. These results are then analyzed and compared to similar returns from other sections of the same module. (Often, the results are tabulated during the class period.

FIGURE 3: COURSE EVALUATION FORM

COURSE EVALUATION Course Name: -----------------------

The best time to evaluate anything is while it is fresh in your mind. Now that this course is nearly over, please take a few moments to complete the questions below. The results of these evaluations are tabulated and used as input to the course review/revision process.

INSTRUCTIONS: Circle the number that best represents your opinion of the statement or question. If you have no opinion, or the question is not pertinent to this course, circle the number 3.

QUESTION		RESPONSE	
1 This course was interesting	VERY	5 4 3 2 1	BORING
2 The course was difficult.	QUITE	5 4 3 2 1	SIMPLE
3 The course was of value to me.	AGREE	5 4 3 2 1	DISAGREE
4 The general quality of instruction was...	HIGH	5 4 3 2 1	LOW
5 I would recommend this course to others.	DEFINITELY	5 4 3 2 1	NEVER
6 Course objectives were presented clearly.	AGREE	5 4 3 2 1	DISAGREE
7 I achieved my personal objectives in this course.	AGREE	5 4 3 2 1	DISAGREE
8 Directions for activities were clear and understandable.	AGREE	5 4 3 2 1	DISAGREE
9 The quality of materials used in the course was...	HIGH	5 4 3 2 1	LOW
10 Discussion and work groups were helpful to me.	AGREE	5 4 3 2 1	DISAGREE
11 The course was well organized.	AGREE	5 4 3 2 1	DISAGREE
12 The amount of hands-on computer use was about right.	AGREE	5 4 3 2 1	DISAGREE

Thank you. Your input will be valuable to students who take this course in the future.

PLEASE WRITE ANY ADDITIONAL COMMENTS ON THE BACK OF THIS SHEET.

Students then see the practical output of a simple computer system.)

Finally, student comments are solicited at the end of each class. A general discussion period is part of the final class meeting, and suggestions may be made verbally. If students prefer, they may enter comments anonomously on the course evaluation questionaires.

FUTURE DIRECTIONS

Although the entire series is not yet implemented, there is already a great deal of interest in its future expansion. The DESKTOP COMPUTER SERIES will serve as a cornerstone for several new and innovative approaches to building computing competencies. Because flexibility is part of the program's design, changes should enhance rather than disrupt the program.

ADDITIONAL COURSES. Modules dealing specifically with agricultural uses of desktop computers are already being investigated. This is a logical next step, based on the demographic composition of the FVTI District. Other areas that are currently under study include CAI Authoring Languages and Systems, Speech Synthesis, and use of videotape equipment under the control of a microcomputer.

WORKSHOP FORMAT. Some of the initial modules utilize a workshop format, where students will develop practical, usable software tools. As interest and enrollment in the program grows, additional special interest groups can be identified. New workshops will be developed to satisfy their special needs. As part of these workshops, software packages will be solicited from publishers for evaluation by an informed, interested student body. These workshops should also provide an excellent forum for exchanging information and student-developed software.

CREDIT COURSES. VTAE credits are not offered for any of the modules in the initial offerings. However, FVTI is proposing to the state VTAE Board that selected modules be considered as credit courses. If approved, the modules will be melded into the existing Data Processing Associate Degree program. Students may take selected modules either as elective courses or as part of a "Small Shop Specialist" option. This option will provide concentrated training for students interested in using small computers in business.

INFORMATION SYSTEMS LAB. FVTI is currently evaluating a proposal to establish an Information Systems Laboratory (IS Lab). The IS Lab will contain a variety of microcomputing hardware and software. Here faculty, students, and others from the FVTI District can meet to solve specific problems. While the majority of course modules are taught at outlying locations, the IS Lab will be centrally located, for use by persons from throughout the District.

SUMMARY

Parents, teachers, accountants, scoutmasters, homemakers, engineers, gas station owners, and farmers all have demonstrable, but different, reasons to develop competencies in computing. Some needs are quite similar, while others are unique. No one solution will meet them all.

Developing a variety of computing competency levels is one of the greatest challenges facing educators today. Traditional courses do not appear to be the answer. A cohesive series of short modules, integrated to allow students to select those which lead to the levels of competency they desire, provides an effective, manageable approach.

FVTI's DESKTOP COMPUTER SERIES addresses the problems in a systematic way and provides a workable method for developing a network of courses to build a variety of computing competencies.

MICROCOMPUTER INSTRUCTION IN AGRICULTURE & AGRIBUSINESS

BY

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Microcomputer use in Agriculture and Agribusiness is no longer something on the horizon but rather a present day reality. The world of microcomputer electronics has enabled the small computer to be available for use as a tool in the making of management decisions in the farm industry. The effective use of the microcomputer will allow the manager of today's fast moving business to assign tedious repetitive tasks to this "noncomplaining workhorse" to obtain management information essential to guiding the business.

One major problem being encountered by managers is to be able to obtain computer programs or "software" that will provide information that the manager wants and not what someone else thought they should have. Since most smaller agribusiness and most farm operations do not have a computer "expert" at their beck and call, it is usually up to the manager or owner operator to "know how to control the workhorse." This person will need to operate or train someone to operate the computer and the software programs and have the ability to "change the program" to meet new needs and desires for information.

Management of capital in addition to production is the key in the 1980's complex fast paced technological era. As we are all aware of, capital or "money" has replaced much of labor in the farm industry. In addition to the great increase of capital in the business, economic conditions have now been changing on a wide swing from "profitable to unprofitable" in a relatively short period of time. This has strengthened the need for initial sound planning and alternative planning under various possible economic conditions to help the manager to know where the business is headed under many pricing structures.

This planning and laternative planning was once available only by the long tedious "pencil method" and more recently by use of large mainfarm computers at some University. Most of the procedures needed to provide this information can now be done by the manager at the place of business with a microcomputer and some of the presently commercially available software programs. "Massaging and manipulating of data" by the computer will help provide the manager the different answers that then need to be effectively evaluated by the manager.

After the planning stages of the business has been completed comes the task of "monitering the business" as the business year progresses. This, of course, brings in the need for income tax records of income and expense information and also for enterprise analysis of income and expense information. These tasks can also be completed very effectively by the computer and a software program. Gone are the days of putting off record keeping until the end of the year and then "seeing how much profit was made when we have nothing else to do."

Computers are coming to the farm and agribusiness industry in Wisconsin and it would appear that the Vocational, Technical and Adult Education (VTAE) districts in Wisconsin need to have personnel teaching these subjects. For the past two years the Madison Area Technical College has started to initiate courses to address these new subject areas.

Computer education and training can take two different avenues leading to about the same end result:

1. One being the learning of a computer programing language to enable the manager to "program a computer" using a language understood by the computer.

2. The second avenue being to teach the student to:

   a. learn how to use the computer operating system.
   b. learn how to use 2 or 3 commercial software packages that will operate on the microcomputer.
   c. learn some of the capabilities and limitations of the microcomputer and software programs.

At this time many agriculture people have taken the first route since not much software has been written for agriculture purposes and very little is known about what the computers and software programs will do. Also Ag people are known to be rugged "do it my way people" and so, of course, they want the computer programs to put out answers "my way" also.

However, we are now seeing many more software programs coming out for agricultural uses and there are sure to be more and better ones as the needs are better defined by users. This brings us to the second option, presenting the process of basic computer and basic program instruction to the student who has little knowledge on the subject and being fully employed usually does not have large amounts of time to get "knowledgeable in the area." Even more so does not want to learn a seemingly "complex programing language" and write a program before it can be used.

This type of person would like to sit down at the machine, learn how to operate it and the software programs and then revise the program to make the program do what they want it to do.

At the Madison Area Technical College, Robert Mountford, one of the five Farm Training Program instructors, has taken the lead and been the innovator in this agricultural area. Over a two-year period of time he has developed the following observations of the student needing computer training in the Farm Training program. These observations follow the second avenue of computer training as listed above because:

1. Very few students will have prior knowledge, or exposure to the use of microcomputers.

2. Basic terminology, word definition, slang terms and recognition of basic components is lacking on the part of most students.

3. Knowing what to expect of a microcomputer system or of different software programs and how they work without ever using one is next to impossible for the agriculture business and farm manager as they have nothing to compare to.

Therefore, the following objectives of the Agriculture computer education at Madison Area Technical College (MATC) can be outlined as follows:

1. To provide materials and sources so that the student may learn the definitions of the "jargon" and the vocabulary of the computer field so that he or she can start to become "literate" within the field.

2. To provide instructional time and hardware use time so that the student may operate the computer "hardware" for a sufficient amount of time to gain minimum competency in its use.

3. To have sufficient instructor guided instruction time and individual practice "hands on time" to learn how to use the computer "operating system."

4. To provide instructional time, hardware use time, and a "Calc" electronic spreadsheet software program that the student may use to learn the fundamentals of this type of software.

5. To enable the student to learn possible uses of "Calc" software sufficient "agricultural" use templates should be provided for the "Calc" program to enable the student to investigate their possible uses in areas such as:
    a. Use of financial analysis procedures on the "Calc" programs.
    b. Use of projected twelve month cash flow construction templates.
    c. Use of ration of balancing and ration evaluation procedures.
    d. Comparative enterprise analysis procedures.
    e. Using "data exchange files," that is, to take data from one program and move it to the "Calc" program for analysis or other uses.

6. To provide the instructional time, hardware time, and software to enable the student to gain minimum proficiency in the use of a "relational database system."
    a. Again, agricultural templates should be provided to enable the student to learn as easily and quickly as possible how this type of software can be utilized in the agricultural area.
    b. It should be compatable with the "Calc" program software to allow data transfer between them.

7. A commercial agricultural business record system and a word processing software program could also be offered to the student to round out their basic education on the use of computers and computer software in agriculture if time and funds are available.

After completing 3 or 4 courses such as these the student should now have a basic understanding of what the computer and some of the commercial software can do in some basic agricultural farm applications. The student should then be better prepared to define their needs, if any, for a microcomputer in their business and to have minimum expectations of "Compared to What?"

It will be noted that these objectives relate to "how to". As the students learn to be literate with a computer and a "software program" they should have the opportunities within the course/s to deal with real or simulated problems involving the uses of the software to provide information for management decisions. When problems involve actual facts and figures of the students the concern of keeping information confidential to the owner becomes an issue. This usually may be solved by the student storing their information on a storage medium, disk or whatever, that is portable and the property of the student.

In meeting these objectives the Agriculture Instructors at MATC have started to get the background training and experience to give this kind of instruction. Three of the five instructors own their own computers and have contributed much to develop curriculum and course content from scratch. This is a slow and time consuming addition to their present workload. Consequently, most of the material is related to the group of persons they are training -- farmer, dairy herd managers, etc. At this point most of these courses have been directed to production agriculture. It is realized that little has been done as of this date for agribusiness even though instruction is greatly needed there also. Agribusiness firms as well as farmers need computer training for use in cash flow, financial management and inventory control, billings, etc.

Some of the typical examples of computer education incorporated into the curriculum of VTAE Agriculture-Agribusiness instruction are as follows:

1. Use of the "Calc" spreadsheet programs with Ag templates for cash flow construction, square method of ration balancing, ration evaluation programs, loan interest tables, production analysis with crop and livestock budgets, and long range financial planning.

2. Use of ration balancing programs designed and programmed by the instructor.

3. Use of fertilizer requirements and comparative cost analysis programs.

4. Use of livestock profitability programs with returns to labor, capital and management.

Other programs to be added to the curriculum as time allows will be the use of:

1. A "file management" data base program for data storage and retrieval.

2. Use of "relational" data base programs for information that can be retrieved for analysis and interpretation, such as:

   a. financial information
   b. dairy herd information
   c. other livestock information
   d. crop record information, inputs, yields, etc.
   e. others, as need arises

3. Use of a commercial record program that will interchange information with "Calc" spreadsheet program.

Some typical examples of agricultural computer education incorporated into the curriculum of other VTAE Agriculture-Agribusiness instruction we are aware of are as follows:

1. The Fox Valley VTAE District (Appleton, WI) will provide all Farm Training Instructors with the use of a microcomputer and appropriate software effective July 1, 1983. One week of intensive training will be provided prior to that time with additional continuing education to be provided as needed. They also have a course in Agriculture Microcomputers as a requirement in all Agribusiness programs.

2. At Milwaukee Area Technical College, teacher developed plant identification drills for horticulture and horticultural math are used. Also, courses in "Agrimarketing" and "Computer Application in Agribusiness" have been taught by James Schug using microcomputer application.

3. Milton Olson at the North Central VTAE District (Wausau, WI) has taught courses on the "Computer in Agriculture" and utilized such training in the Farm Operations Program.

4. At Western Wisconsin Technical Institute (LaCrosse, WI), Hilbert Hoof has taught microcomputer based courses in their Farm Operations and Farm Training Programs.

Certainly there must be many more in other VTAE districts that we haven't heard of.

Advantages of computer education in agriculture and agribusiness are obvious. The possibilities for its use are practically endless. It is a new skill persons in these occupations will need and it is the mission of the vocational-technical education system to provide this training. There are disadvantages also. Those which have been encountered to date are:

1. The cost of equipment to set up a computer instructional area is expensive when viewed in most school budgets. However, keeping in mind the Agrarian reform and the Industrial reform which substituted machines and capital for labor, the computer will at some date in time be viewed as another "essential capital" investment by many persons in the industry and vocational education. Until that time "capital investment" limits the number of teaching stations and the number of hours that a student may use the station.

2. Computer stations should not be used as a "service tool" by the student or by the educational course offerings. Data bases and record programs should be used for educational purposes only, not allowing the student to "use the computers to keep personal or business records."

3. Microcomputers are relatively new and everyone is curious. Because of the lack of enough teaching stations and their cost, priorities should be given to students who can utilize this training in their present or future jobs.

4. Software packages that are useful can be defined as:

   a. "Calc" spreadsheet programs.
   b. File manager data base programs
   c. Relational data base programs

5. The problem in selecting and becoming proficient in the use of a software package is that "you have to have used one to be able to know what to compare something to anything."

   a. All appear to have some "quirks that someone wishes to work differently."
   b. It takes 40 or more hours to become familiar enough with a software package to be able to begin to use it effectively.
   c. It may take 10 to 40 hours to set up and revise 3 or 4 times each template on a "Calc" spreadsheet.
   d. Data base file procedures, screen procedures, selection and report procedures may take 10 to 100 hours to set up and revise.

6. Some software is only adaptable to certain kinds of computers.

7. Many instructors have not received adequate training to teach such courses. Inservice training may help the instructor to get started. However, it appears that the best way is to "jump in" and start learning.

The overriding objective in microcomputer education for farmers and agribusiness is to lay the groundwork for a self-service skill training that meets their financial management needs. They certainly are going to have personal computers but the issue is whether or not they will be able to use them effectively in their management. The key is to plan training that is flexible, versatile and that can be adapted to changing needs and changing technology in farming and agribusiness. Computers are the tool they need to become more and more efficient. In the opinion of the authors, we've scarcely scratched the surface.

THE COMPUTER IN BUSINESS EDUCATION AND CAREERS

By Mel Hynek and Eric P. Schluter

One of the schools' responsibilities is to prepare students for future employment. A major objective of high school business education curricula is to provide students with a background enabling them to enter the business world upon graduation and to function effectively on the job. To accomplish this, business education students need to gain insights into the business world they will enter. Thus, there is a need for interaction between the schools and employers concerning what should be taught in business education curricula.

The widespread use of electronic computing equipment has affected the duties of many white-collar jobs. Consequently, business-related occupations are becoming more dependent on electronic systems for information to enable them to perform their daily job functions. An indication of this conversion is the marketing thrust of the Tandy Corporation's Radio Shack computers. The TRS-80 microcomputers were originally built for the computer hobbyist, but as a result of recent model changes the major market is now businesses at all levels. This increased use of electronic equipment in business occupations will significantly influence the high school business education curriculum.

What will be the impact of the present-day electronic revolution and possible future technology on students' lives? No one has all the answers to this question, but this article discusses some directions employers have taken or are likely to take in the future that will have an impact on business education as we know it today.

The Curriculum

Accounting Methods

The majority of accounting functions in medium to large businesses are automated. With the development of microcomputer technology, small businesses are rapidly changing from manual to automated accounting methods. Students enrolled in high school accounting courses therefore need to become familiar with computerized accounting procedures and processes. Textbooks and instructional accounting computer software packages are available today that are designed for high school level students. Some examples are *Computer Oriented Accounting (13)*, *Automated Accounting for the Microcomputer (2)*, *Microcomputer Oriented Accounting: A CAI Approach (14)*, and *Micro Integrated Computerized Accounting Systems (12)*. These accounting packages allow the student to analyze accounting transactions, code the transactions on input forms, and enter the data into the computer for processing. After processing, the student corrects any coding or keying errors as one would in a business situation. The computer packages are usually written in FORTRAN or BASIC programming language and are available at a reasonable cost. Schools with access to microcomputers or timesharing computer systems should explore the possibility of incorporating computerized accounting concepts into the regular accounting courses. If some type of computer access is not available, computing equipment vendors are usually willing to bring equipment into the classroom and demonstrate accounting applications for students. Field trips also provide students some exposure to computer concepts and methodology without hands-on experience.

A trend in the teaching of accounting at the high school level is to stress student understanding of accounting concepts and the relationship of accounting to management decision-making. This approach de-emphasizes the drudgery of extensive paper-and-pencil exercises and calculations. According to Rose, accounting, the language of business, should develop in students an understanding of how owners and managers use accounting information to make decisions (16). Accounting teachers need to help students by developing a process that will teach decision-making skills. The process should include analyzing the problem, generating alternative solutions, and choosing from alternative solutions.

Keyboarding

Keyboarding (which is not the same as typewriting) is a popular concept in business today. It is defined as the act of entering alphanumeric data on a desk-top unit. The data is often transmitted to a computer for storage or manipulation. Keyboarding has expanded into other career areas beyond the secretarial/clerical area. For example, through keyboarding accountants enter journal transactions into the general ledger, airlines handle requests and reservations, insurance agents make inquiries and changes in customer policies, bank loan officers find out information about customers' savings accounts. As Goodrich states:

> In considering the present applications of keyboarding, one cannot help but remember when typewriting was a skill required only by secretaries. While those days are not very far behind us, they are just that--behind us! Gone are the days when the typewriting course was designed primarily to prepare for secretarial jobs. Today's keyboarding course must prepare men and women for their careers, any one of which may have a typewriter-like keyboard in it. (8)

What should be the business education teacher's role in dealing with this new concept of keyboarding? The skills emphasized in traditional typewriting courses continue to be essential. They include learning keys by the touch system, developing speed and accuracy, proofreading, following directions, and meeting deadlines.

Goodrich describes additional skills needed for keyboarding:

> Careers requiring keyboarding need employees who will competently enter data not only from written material but also from orally supplied material. In both cases, the employee will frequently be required to mentally transform the information given into a form acceptable for entry on the keyboard. There is a need for a better understanding of composing functions, so more composing should take place in the first keyboarding course. (8)

Textbooks such as *Keyboarding for Information Processing (9)* are available. However, there is more to developing a keyboarding course than the selection of a textbook. Dickey-Olson suggests that students completing a keyboarding course should be able to perform the following skills:

- Demonstrate the correct "touch" system techniques for operating the alphanumeric keys.

- Demonstrate the correct "touch" technique to be used on a ten-key numeric pad.
- Demonstrate a straight-copy speed of 30 words-per-minute and an accuracy level of not more than two errors-per-minute.
- Demonstrate the ability to work from typed and rough-draft material.
- Demonstrate the ability to detect and correct errors in completed work (proofread).
- Demonstrate the ability to follow oral and written directions.
- Demonstrate the ability to backspace and correct errors.
- Transfer the "touch" system of keyboarding skills for most of the electronic automatic repetitive keyboards currently on the market. (6)

Business education teachers should tailor their keyboarding course objectives to their respective schools, taking into account such things as grade level and academic abilities of students, and equipment availability. It should be emphasized that the skills associated with keyboarding do not necessarily mean the acquisition of additional new equipment.

The Office of the Future

Any business education teacher who has found it difficult to accept technological changes in the past will find a look into the future to be almost beyond belief. A major target of the electronic revolution is "the office." Why? According to the Stanford Research Institute, during the ten-year period from 1960 to 1970 factory worker productivity rose 83 percent while white-collar productivity increased 4 percent (20). Dartnell's 1981 cost estimate for a dictated business letter transcribed and then typed on a traditional keyboard is in excess of $6.60 (15). For the office of the future, the name of the game will be increased productivity.

There has been a great deal of predicting about the form the office of the future will take. The following pages discuss several areas on which there appears to be consensus.

Word Processing Systems--

The major office revolution centers on the inclusion of word processors (also called text-editors). By early 1981, over one million word processing units were in use, with an additional 1.5 million anticipated by 1985 By 1983, the demand for word processing operators is expected to exceed 2.5 million individuals (10). The features of a word processor include text creation, text revision, file maintenance, file merger, and electronic mail. The text is entered and stored electronically through a keyboard; it is viewed on a video screen. Additions, corrections, deletions, and insertions can be made electronically. Only then is a copy printed on paper, shipped electronically, or stored permanently. With one typing of a form letter, an "individualized" letter can be produced for each customer, agent, or creditor based on information on the individual stored in a large data base.

In the office of the future, word processing systems will be taking on a new look. According to Adler:

> It is clear that office automation, with its increased use of the mini and microcomputers, is moving closer to data processing from a technological viewpoint (1).

Microcomputer systems are able to perform common data processing functions such as payroll, accounts receivable, accounts payable, and general ledger. They can also generate various reports for management while handling word processing responsibilities such as text editing, data entry, and information retrieval. The International Word Processing Association projects that, in the 1980's, automated text-editing equipment (basically microcomputers) will be as common to offices as the electric typewriter is today. Kelly Services predicts that by the end of the century, "over 70 percent of the nation's work force will be in ... the automated office" (10).

Electronic Mail--

The office of the future will also utilize electronic mail, which Edwards defines as follows:

> Electronic mail refers to the delivery, via electronic means, of messages that would otherwise be transmitted physically through the postal system or verbally via the telephone. As such, electronic mail may be considered a faster, cheaper, or more convenient alternative to the postal system or voice network (7).

For the most part, electronic mail systems are still in the prototype stage. However, such systems and services are already available. They have gained some intensive use in Great Britain and in a few large U.S. corporations. A page of copy can be sent coast to coast via electronic mail at a cost of less than a first-class stamp. It is estimated that, by 1985, 23 percent of the current amount of U.S. first class mail will be distributed electronically (15).

Electronic Filing of Documents--

Closely associated with electronic mail is the electronic "filing" of documents which can be retrieved, updated, or deleted electronically at a later time. Many insurance companies currently use this procedure--storing, updating, and reporting policies and claims on videoscreens, and generating paper copies only for legal records.

What impact can these changes have on the business education curriculum of the future? Present business education instruction centers around the use of paper, whereas the office of the future will tend to be paperless. Will teachers be preparing students for future jobs in which they will probably never type on paper, fold a letter, address an envelope, erase, make a carbon, or file a piece of paper?

The Human Factor--

Ergonomics, human engineering, anthropometics. These words are mentioned with increasing regularity in the computer industry as operators, system planners, union management, government agencies, and equipment manufacturers struggle to assess the physiological and psychological impact of computers on the people who use them (17). The office of the future will undoubtedly utilize equipment designed to reduce eyestrain, neck, shoulder, and backache, and fatigue. Design changes will include such features as higher CRT resolution printing, less screen reflection, tilting and rotating CRT screens, detachable low-profile keyboards, document-holding capability, and adjustable workplace furniture.

The Human Voice--

The office of the future will use the human voice as an input vehicle to computerized systems. Miller predicts that

> In the future--perhaps as soon as the mid 1980's--speech recognition will replace touchtone telephone input as the preferred input capability to computer systems. (11)

Strategic, Inc., a San Jose, California, research and consulting firm, has predicted that sales of speech synthesis equipment in the information processing and consumer business will grow from $23 million in 1981 to $495 million in 1985 (19). This firm also predicts that high-quality speech will become available on chips costing less than $15 in large quantities.

Talking to the computer rather than keyboarding to the computer--what are the possible implications of this development for the business teacher? In the past it has been difficult, at best, to place students with limited secretarial skills such as typing in clerical positions. Voice recognition systems which are already available have allowed quadriplegics, disabled persons, and others with limited manual dexterity to work effectively with computer systems. These systems will greatly expand the employability of students possessing few, if any, keyboarding skills.

Personal Qualifications--

What kind of person will work in the office of the future? What duties will she/he have? There is not much consensus on these questions, but we do know that this person is likely to be someone who is different from the person now known as a "secretary."

According to Stewart:

> The day may not be too far off when secretarial jobs will require a master's degree in business administration and be regarded as an entry-level step into management...there will be more creative-type positions, fewer dog-work-type tasks, and there will be far more tasks. (18)

These people will be heavily involved with information management. Part of their duties will be to help others analyze available information and prepare reports.

Cunningham has yet another view:

> The secretarial station will become part of the corporate information bank or the data bank that is kept regarding all corporate activities. The secretarial station will become an information management terminal. (4)

Already many companies have prewritten programs and data storage that allow secretarial personnel to generate reports, summarize information, and produce business predictions. Companies are developing new secretarial-related job descriptions which include increased responsibilities and salaries, and new job titles. Many old job titles are being changed to the new "administrative assistant." Historically, business education has not attracted much of the male school population. Higher salaries and new job responsibilities may attract more males to this traditionally female area of the curriculum.

Productivity--

Will the office of the future attain the desired increased office productivity? Yes and no. For the most part, the high-technology office equipment has lived up to claims made by the respective manufacturers. Why, then, have not all companies seen increased office productivity after installing it? Most failures can be attributed to "human" rather than "machine" problems. Companies that have not correctly addressed the issue of the relationship of people to evolving office technologies have failed to achieve increased office productivity. According to Anderson, it is important not to regard people as extensions of office machines. Assembly-line type demands should not be placed on office workers. It is management's responsibility to give workers a variety of duties which allows them to use the skills they possess (3).

Business education teachers have the responsibility of informing their students of the likely changes in future office environments. Anderson explains one of the most crucial tasks business educators can perform to prepare students for the future. That is, when students leave the educational setting, they must do so with the knowledge that this is only the beginning of what is to come in office technology and the acceptance of lifetime changes that will be demanded of them (3).

At the same time that business educators are faced with the dilemma of how to prepare their students for the future, they must also prepare themselves for the changes in business education that most certainly will come.

Career Awareness

Before students begin training for a career, it is important for them to make an informed career choice. Despite wide use, most people still do not know how computers operate or what procedures are necessary to make them useful and productive tools. An important first step is an understanding of computer operation and the tasks to be performed.

Books, filmstrips, movies, and videotapes are now available on the high school level, which deal with computer design and operation, data processing applications, and computer-related careers. A variety of information concerning data processing careers and salaries is also available from such organizations as the local Better Business Bureau and the American Federation of Information Processing Societies. Publications such as *Datamation* supply up-to-date information on careers (5). Classified advertisements are an excellent source of information and can be used as a starting point for students researching the data processing job market. All these materials are valuable resources for enhancing career awareness. However, none of these resources gives students any direct knowledge of computers. This gap can be filled by enlisting the help of the business community. A well-planned field trip can provide students with a closeup look at computer hardware and the interaction with personnel in a variety of careers, as well as the chance to observe some computer uses.

A field trip can offer tremendous educational opportunities if the proper groundwork has been laid. For example, business personnel must be informed of the students' backgrounds so that their explanations and remarks will be appropriate for the audience. It is also important that the organizer of the field trip convey its goals and the types of situations that students should be able to observe. And not only the teacher conducting the field trip should be prepared; the students should also be prepared if they are to receive the maximum benefit from the experience.

The teacher can provide much of the preparation by presenting the concepts of data processing, and exposing students to some of the terminology they are likely to encounter. More specific preparation can be provided by inviting someone from the proposed field trip site to the school to discuss the company and the role of data processing in its operations.

As important as the preparation is the followup. Student reports on the field trip give them the opportunity to organize the information they have received. A followup speaker from the company can reinforce many things students have seen and heard, and give them an opportunity to clear up any questions they may have.

For any field trip experience, the first step is to establish contact with the right person. In small businesses, the appropriate person to contact is usually the owner or president; in large businesses, it is the director of data processing. It must be emphasized, however, that it is the teacher's responsibility to take the leadership role in providing preparation for everyone to ensure a successful experience.

Data Processing Careers

With the introduction of the computer into the business world, a new set of tasks developed, most of them centered on the functioning of the computer. As the number of individuals in computer-related jobs grow, clerical and bookkeeping positions are being phased out. What computer positions are now open to students?

Large Businesses

In large organizations, the data processing employees tend to become specialists with expertise in a limited number of tasks. These organizations also present the opportunity for advancements and promotions, possibly to management-level positions.

In such business settings, the person who works most directly with the computer is the computer operator. Several levels of this position may exist. Beginning operators usually work with peripheral equipment such as card readers, tape drives, and printers. Experienced operators are at the computer console, responsible for the running of jobs and the resolution of problems which may arise. A high school diploma is the minimum requirement for the entry-level position, but some training at a technical school is preferred.

Another person who works closely with the computer, but in a much different capacity, is the systems programmer. The person in this position is responsible for maintaining the computer's operating system, a collection of programs which control the computer's functions. Such a position requires a good background in both hardware and software; it is usually filled by a college graduate with some courses in computer science.

The two positions just described are related to the functioning of the computer. The greatest number of jobs, however, are those concerned with developing applications for the computer. One such position is that of systems analyst. The systems analyst is a problem-solver on a large scale. He or she must analyze a general problem situation and devise a master plan for developing a data processing system which will best solve the problem. The systems analyst is the leader of a computer team responsible for developing and implementing that solution. Such a position usually requires a college degree. The systems analyst also needs an understanding of both business and data processing concepts, as well as the ability to work with people who have a wide range of company backgrounds and responsibilities.

One of the people helping to implement a data processing system is the computer programmer. The programmer develops solutions for specific problems, always following the master plan. This task includes designing the solution, translating the design into a computer program, and then testing and debugging the program. Although a two-year degree often qualifies a person to be hired as a programmer, a four-year degree allows the person to begin at a higher level or to advance more rapidly.

Small Businesses

As minicomputers and microcomputers have become available, and their cost has dropped, increasing numbers of small businesses have begun to use such equipment. These businesses include anything from a one-person shop on up. They have neither the need nor the budget for large data processing staffs of highly specialized individuals. In most cases they need one or two employees who can perform all the tasks required to use a small computer system. Such persons may not necessarily be required to design systems and write programs; however, they may need a knowledge of programming in order to modify programs purchased from outside sources to meet the company's needs.

Career Training

For all business students, practice on word processors and learning to enter data through keyboarding will be beneficial. Availability of word processing programs for microcomputers makes such experience feasible. And the additional use of microcomputers for grade reporting, class lists, and attendance makes them a financially sound investment.

For students interested in computer operations, employment may be immediate upon high school graduation, or after one year of technical school. The necessary training requires the availability on a regular basis of a variety of equipment which very few high schools possess. The schools can, however, provide a general background in computers and their operation. In some cases it may then be possible to place students in summer or after-school intern positions with local businesses to provide actual hands-on experience.

For students interested in computer programming, there is no substitute for actual programming of a computer. The low price of microcomputers makes it irresponsible to deny students an opportunity to gain computer access. Rental of time-sharing equipment or off-time use of local business computers provides an alternative form of access.

When learning to program the computer, students should see and be expected to use good programming practices such as internal and external documentation. (See the article "Computer Science: A Secondary School Course.") The techniques of structured design, for example, have come into common use in the business community. Although this structure is more evident in computer languages such as Pascal and COBOL, it is a valuable concept for all business-oriented programmers. Yourdon presents a clear description of the concept (21).

Computer Languages

The choice of computer language for business education can depend upon many things. Very often a language is used simply because it is available. But if options exist, the choice should be based upon the uses for which the languages were developed and the advantages and disadvantages to students. Four commonly mentioned languages are BASIC, Pascal, FORTRAN, and COBOL.

BASIC is a language commonly used in schools and on many of the new microcomputers. It is an interactive language providing the user with immediate feedback. It is also fairly easy to learn, allowing students to write and run simple programs on the first day.

Pascal is also an interactive language which is increasing in popularity, especially in the colleges and universities. Although not quite as easy as BASIC, it is ideal for teaching the concepts and techniques of structured programming.

FORTRAN is a language well suited for use in the fields of mathematics, science, and engineering. Recently a structured version of FORTRAN was released, which is consistent with the current trend in business.

COBOL is a language developed for business applications. Although it is somewhat difficult, it is a tremendously popular language, especially among large businesses--thus creating a very good job market for COBOL programmers. It can also be made to conform to the rules of structured programming.

Many small businesses use RPG, a specific use language designed for generating reports. Because of its limited applications, it is easy but it does not require the student to learn how to program the computer.

Whichever programming language is used, the objective should always be good program design and good programming. (RPG does not conform to these requirements.) The language is just a tool.

Conclusion

All functions of business from accounting to management to clerical operations are being computerized. Business education teachers must keep abreast of these changes in order to provide students with the best opportunity for success in the business world. And they also need to update their own skills through in-service courses, professional reading, and on-the-job experiences.

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MICROCOMPUTERS IN VOCATIONAL EDUCATION--BUSINESS EDUCATION

By A.C. Krizan and Anne P. Crum

Integration of Microcomputers Into Business Education Curriculum

Instruction using microcomputers has been emphasized more in business education than in most other areas of vocational education because businesses have been using computers longer than other vocational areas. Due to the wide use of computers in business, business educators have more software available in their area than do the teachers in the other vocational areas. Teachers in all courses of the business education curriculum need to incorporate microcomputers into their instruction. Schools should not limit the use of microcomputers to only one or two courses.

The word processing portion of an office procedures course is one of the ideal places to integrate microcomputers into instruction. Most brands of microcomputers have word processing software available. Most persons in business, both secretaries and managers, will find it necessary to create written correspondence using word processing software.

A sufficient number of microcomputers should be made available to teach keyboarding. Students taught keyboarding on a microcomputer would be one step ahead when they encounter microcomputers in other business education courses. Keyboarding instructors would benefit from instruction with microcomputers in that they would not have to commit so much of their time to grading and could concentrate on a better quality of instruction.

Accounting/bookkeeping is also well suited for microcomputer instruction. One of two approaches may be used when teaching accounting with a microcomputer. One approach is for all instruction to be conducted using a microcomputer. In the other approach, the microcomputer is used only in selected portions of the course, i.e., every fourth chapter or practice set.

All business education students should receive some type of introduction to data processing instruction in order that they may become computer literate. Students in this introductory course should learn about the various applications of computers in the business world. Instruction should not be devoted entirely to theory but should include "hands-on" experiences.

Microcomputers should be integrated into the business education curriculum. This integration will provide a realistic view of what the students will encounter when they enter the business world.

Effective Uses of Microcomputers in Business

The use of computers in business is not limited to large organizations. The recent escalation of microcomputers has led to many small organizations finding numerous applications for computers. Some large organizations are using microcomputers along with mainframe computers while some are using only microcomputers. Many small organizations are using timesharing or microcomputers for data processing applications. There are a myriad of uses for microcomputers across the United States.

Some of the more common microcomputer applications are accounts payable, accounts receivable, and payroll. One of the benefits of using microcomputers for accounts payable is to ensure that the business organizations receive the maximum discounts by timely payments. Accounts receivable programs greatly reduce the time necessary to maintain the accounts receivable ledger and the time spent on preparing customers' monthly statements. The microcomputer is outstanding for maintaining payroll records because it calculates the pay due, keeps a continuous record of deductions such as insurance and credit union, computes local, state, and federal tax, and prints the paychecks.

Word processing applications using the microcomputers include the preparing of final copies of letters and reports and the printing of mailing labels. A major advantage of using a microcomputer for preparing final copies of written correspondence is the ease with which changes can be made to rough drafts. Ease in updating mailing lists is an advantage in using microcomputers to print mailing labels . Some unique uses of microcomputers include keeping cumulative totals for fishing tournaments, keeping records of bridal registery gifts, and assisting in title searches on land deeds. For example, Operation Bass, Inc., notifies participants in fishing tournaments each week of their standings after the most recent tournament. The number of hours in computing cumulative totals for each participant has been greatly reduced through the use of a microcomputer. A department store in the northeast maintains records of gifts that each bride has received to avoid duplication. In the small town of Cadiz, Kentucky, a law office uses a microcomputer to conduct title searches. This office also uses a microcomputer to ensure that closures on land deeds are prepared according to applicable laws.

The number of uses of microcomputers in business will continue to increase as organizations become more aware of how applications can increase their job proficiency. Software companies are developing programs that will increase the usefulness of the microcomputer.

Improvement of Instruction Through the Use of Microcomputers

When looking at the use of microcomputers from the student aspect, there are several ways instruction may be improved. Although it may take more time to create your system initially, in the long run instruction may be improved substantially by providing faster feedback, individual tests, and centering instruction around the student.

First, the student may obtain test results faster when examintions are taken on and graded by the computer. More efficient learning takes place if reinforcement is immediate rather than delayed. The student's correct responses are reinforced and notice of incorrect responses is given when the computer grades the exam upon test completion, rather than having the student wait for the instructor to grade it.

Secondly, test banks may be created and questions selected either randomly or by the instructor through the use of microcomputers. Thus, each student may have a different examination with special emphasis given to particularly difficult tasks. This also alleviates the problem of tests "getting out," and of making up a different test for students who are ill or for different sections of the same class. As a result, each student is tested fairly. With the above in mind, those students receiving individualized instruction may determine when they are ready for an examination; testing does not become a hindrance in meeting the individualized goals.

Thirdly, and maybe most importantly, with the aid of a microcomputer, emphasis may be switched from teacher-oriented to student-oriented instruction. The microcomputer becomes a teaching aid. Exercise sheets can be placed on the micro, and the student may practice (within limits) all concepts related to a unit until mastery of content is achieved to the student's satisfaction. Each student then becomes the master of his/her own learning process by skipping exercises already familiar to them and repeating new material until mastery of the content is made.

Now let us examine how instruction may be improved from a purely teacher-management point of view.

If exams are placed on the micro, each student's grade could be placed in that student's record immediately, rather than the teacher manually recording each grade. This procedure would make it easier for the teacher to access students' records, indicating their progress within a particular subject area. The instructor becomes more effective by having more time to pinpoint the deficiencies. The role of the teacher now is teaching and helping students overcome their deficiencies, rather than record-keeping.

Another benefit for the instructor is that a microcomputer, if programmed to do so, can indicate strengths and weaknesses of a measuring instrument by compiling statistics on test questions. Item analysis on each question may determine such things as difficulty and/or discrimination indicators.

In the area of student advisement, the teacher can be helped greatly by the microcomputer. There is software available that can produce a printout of courses and/or requirements a student has yet to complete. Thus, the problems created when an advisor overlooks a requirement, can be greatly reduced.

In summary, microcomputers have just begun to influence instruction. They are an unlimited resource in taking the mundane tasks out of teaching by grading and recording scores, by improving testing instruments, and by centering instruction around the student.

Microcomputers Can Improve Learning Materials

For a business educator, improving learning materials is easy--with word processing. Teaching material such as handouts, student objectives, tests, exercise sheets, and class records may be keyed once and stored on a diskette or some other form of magnetic medium for future use, revisions, and updating. When the need arises the information on the diskette is accessed, and/or printed. Stencils can be made from letter perfect copy (A MUST IN BUSINESS EDUCATION), thus ending forever the drudgery of retyping and correcting masters. The advent of word processing has made it possible to delete, insert, and copy sections of text easily. Additionally, multiple copies can be run by simply changing one command. If the printer on the micro is too slow or copies are too expensive, the printer can make letter perfect stencils (spirit, mimeograph, offset) when the output device is an impact printer.

In this area, business educators should move to the forefront in making it easier to take an idea (input) through to its final stages of printed copy (output). Word processing has given us the capability to produce the printed page faster and with better quality. Business educators may want to share their expertise in using this capability with teachers in other vocational areas.

One word of caution, however, each microcomputer has several word processing software packages available. Some software packages being used are the following: Super Scripsit by Tandy, Radio Shack, 1800 One Tandy Center, Fort Worth, Texas 76102; Wordstar by Micro Pro Int'l Corp., 33 San Pablo Avenue, San Rafael, California 94903; Easy Writer II by Information Unlimited Software, 2401 Marinship Way, Sausalito, California 94965; Apple Writer II by Microsoft, Apple Computer, Inc., 20525 Mariani Avenue, Cupertino, California 95014. Analyze each software package for its strengths and weaknesses. A few questions you might ask are:

*Is editing easy? (insertion, deletion, word wrap, search and replace)

*Are the commands easy to remember and logical?

*Does the software allow the system to display lower and upper case characters?

Choose the one which is easiest to use and that meets your needs for producing learning materials.

Ineffective Uses of Microcomputers in the Classroom

Microcomputers can increase the efficiency of a business organization and a classroom, but can be a large investment of money with little return if used ineffectively. Video games may be an interesting way to interest students in the microcomputer and to train them on how to operate the computer; however, students may tend to concentrate their efforts on video games rather than educational software. Video games may be effectively used as a motivational tool, but caution should be taken so not to overuse them.

Microcomputers can be used for many purposes but may not replace the teacher. Administrators may be tempted to reduce budgets by replacing teachers with microcomputers and teachers may be tempted to increase their free time by replacing their instruction with microcomputers. Neither of these methods will result in a higher quality graduate. Microcomputers can be a powerful tool when used to complement instruction but will lower quality education when used in lieu of a teacher.

If the microcomputer is to be effectively used, the student must have the opportunity to operate it. Why have the equipment if the students are not allowed to use it because "they may break it?" Many times students are given this excuse when the real reason for the inactivity of the equipment is the teacher's fear that a student will ask a question which the teacher will be unable to answer. Microcomputers are no more fragile than any other training aids when their use is properly supervised.

When effectively used, microcomputers can greatly enhance instruction. As with all training aids, prior planning for the use of microcomputers in the classroom is required to avoid haphazard, non-directional time filler.

Microcomputers Change Teacher/Student Roles in Learning

Historically, educators have changed their approach to teaching, depending upon the thought and current trends of the times. Microcomputers are becoming a part of the trend in shifting from teacher- to student-oriented learning.

As with any other media device, the microcomputer will not replace the instructor in the classroom but will act as an instrument to improve instruction. Just as film strips and audio cassettes have enhanced instruction so will the microcomputer. It will provide computer assisted instruction (CAI) to individual students much like programmed instruction has individualized instruction in the past. As explained in the section on improving instruction, the teacher with the aid of a microcomputer can move from dictator of instruction to manager of it. If instructional material is placed on the computer, a student may progress at his own rate and ask for teacher assistance only as the need arises or more indepth coverage of a topic is needed. Because of immediate feedback, each student becomes motivated to proceed based on his/her own success. Realistically, not all students will have enough success to motivate them to progress. That is when the teacher steps in to motivate--an area the computer can never replace.

Integrating Microcomputers into the Total Curriculum

Integrating microcomputers into the business currciulum should occur in every class offered in business education. Its integration is limited only by the instructor's knowledge _or_ willingness to learn. With the advent of information processing, no area will be spared from the infiltration of automation. Therefore, the microcomputer may help students to understand office automation in a limited sense.

The following are examples of ways micros may be used throughout the business curriculum.

* Canned programs may be utilized to illustrate the difference between manual and automated systems. Illustrated further, an accounts payable software package could be used by students to actually see the savings in time created by the automated system.
* Word processing software may be utilized by students to see how text editing is used to move, insert, delete, and copy text. Formatting changes illustrate how easy it is to change spacing and to justify margins.
* Construction of form letters can be an exercise for business communication classes. Standard paragraphs would be created to form a library which

would then be placed in a paragraph library on a floppy diskette. Students could then see how a form letter can be created without rekeying the body of the letter.

* Utilizing data from printouts is another way to familiarize students with the output phase of microcomputers. Each student would be required to write a report utilizing the values found on a printout.

* Collecting articles is another way of generating interest in microcomputers. Several times during the term an assignment may be given to find an article on different topics. These topics may range from computers and the job market to telecommunications. Again, the diversification of micros in business is limited only by the instructor's imagination.

* Evaluating software is a way to illustrate to the students that buying software is like buying clothes. Each software package must be evaluated on what it can do, how easy it is to do it, and with what resources it takes to do it with.

* The Visicalc program could be used in business class to project the amount of interest that would be paid when different rates are used. It can also calculate the total amount of interest for different periods of time.

* Miscellaneous activities may include:

- field trips to local businesses using microcomputers,
- guest speakers from your locality,
- vendor displays and promotional material,
- and flowcharting systems.

Almost everyone who has learned to operate a microcomputer has no qualms about how much time it may save or about the quality of the product produced by the machine. Computer literacy for students is no longer a desired competency but a required one. Therefore, business educators must be able to help students meet this competency by integrating microcomputers into their classroom.

Software Packages for Business Education Instruction

A multitude of software packages is available in the business education area. The problem is not in finding the software but in determining the most suitable software packages appropriate for a particular school. The software packages needed to accomplish the objectives of the school system need to be selected prior to the purchasing of the hardware.

It is not practical to discuss all of the software packages that have been implemented successfully into the business education curricula. A brief discussion of the software packages seems appropriate. A useful and practical application of a word processing software is the preparation by an office practice class of a registration list that was used by over 1200 students in student elections. Office Practice classes can also help student organizations by preparing thank-you letters to be sent to business persons in the community recognizing them for their assistance.

The major sections of accounting (accounts payable, accounts receivable, general ledger, and payroll) can be easily taught using software packages from the Tandy Corporation. Two methods of integrating them into the classes which have been successful are using the microcomputers to prepare practice sets and using micros to summarize instruction at the end of each major unit of instruction. Another software package for bookkeeping that has been successfully integrated is Automated Accounting for the Microcomputer by the South-Western Publishing Company.

A software package which can aid the teacher by reducing the amount of time spent grading is Basic Information Keyboarding Skills from the South-Western Publishing Company. This package when implemented into a Typewriting I class will enable the student to develop skill in operating a microcomputer to input and retrieve information. It allows such flexibility so that students may work at their own pace.

Summary

Schools throughout the United States are successfully implementing microcomputers and this software into the business education curriculum. This integration should be as realistic to the business world as possible. Microcomputers can improve instruction as well as learning materials. They can be extremely effective in reducing time spent on administrative chores. In order for teachers to integrate microcomputers into the curriculum, they must remain flexible in order to meet the challenge and to provide quality programs.

Selected Periodical List

Business Education Forum, 1906 Association Drive, Reston, VA 22091

Classroom Computer News, P. O. Box 266, Cambridge, MA 02138

Compute, 515 Abbott Drive, Bromall, PA 19008

Courseware Magazine, 4919 N. Millbrook #222, Fresno, CA 93726

Creative Computing, P. O. Bo 789-M, Morristown, NJ 07960

Educational Computer, Box 535, Cupertino, CA 95015

Educational Technology, 300 N. Zeeb Road, Ann Arbor, MI 48106

Electronic Education, P. O. Box 20221, Tallahassee, FL 32304

Electronic Learning, 50 W. 44th Street, New York, NY 10038

Micro, P. O. Box 6502, Chelmsford, MA 01824

Personal Computing, Box 307, Martinsville, NJ 08831

Software News, 1301 South Grove Avenue, Barrington, IL 60010

TRS-80 Microcomputer News, P. O. Box 2910, Ft. Worth, TX 76101

80 Microcomputing, P. O. Box 981, Farmingdale, NY 11737

TEACHING "FILING RULES"--VIA COMPUTER-AIDED INSTRUCTION

By Craig Agneberg

Knowledge of the "Rules for Alphabetical Filing (1)" are necessary for anyone in the field of records management. All personnel who use files of any type--files for paper records, files on microfilm, or files in magnetic memory--need to be able to flawlessly "file and find". Whether it is a quick search through one filing cabinet, a search through the many files of a large corporation or government agency, a need to retrieve a sheet of microfiche from a file of thousands, or the use of a records index on a word processor or computer terminal, knowing the "rules for filing" is invaluable preparation for all kinds of information storage and retrieval. To file and find, it is necessary to use standardized "rules for filing".

Filing rules have traditionally been taught in two ways. One approach is to have a teacher review the rules and then have students practice the rules by working through exercises. This first method is often coupled with the second approach which utilizes a filing rules practice set. Practice sets provide practice and simulate a realistic office environment.

Oftentimes filing rule practice sets are time consuming (for both teachers and students), confusing, costly, and are regarded as "busy work." Most students learn the filing rules by simply memorizing them and then practicing them in problem situations. With today's changing office technology, it's time that computers be used to help in the teaching process. Filing rules lend themselves to computerized instruction in much the same way we are currently teaching them in the classroom--by drill and practice. "Any subject area in which a stable body of content needs to be learned through repetitive associations is amenable to development as a drill and practice package." (2)

The Instructional Program

Two computer programs have been designed by two business educators at the University of Nebraska-Lincoln to aid teachers and students in learning and testing the filing rules. The filing rules incorporated into the program are the Rules for Alphabetical Filing published by the Association of Records Managers and Administrators (ARMA). A goal of ARMA is to eventually standardize the filing rules used in offices. With this goal in mind, secondary and post-secondary institutions using these new computer programs can now teach the ARMA rules via computer aided instruction (CAI).

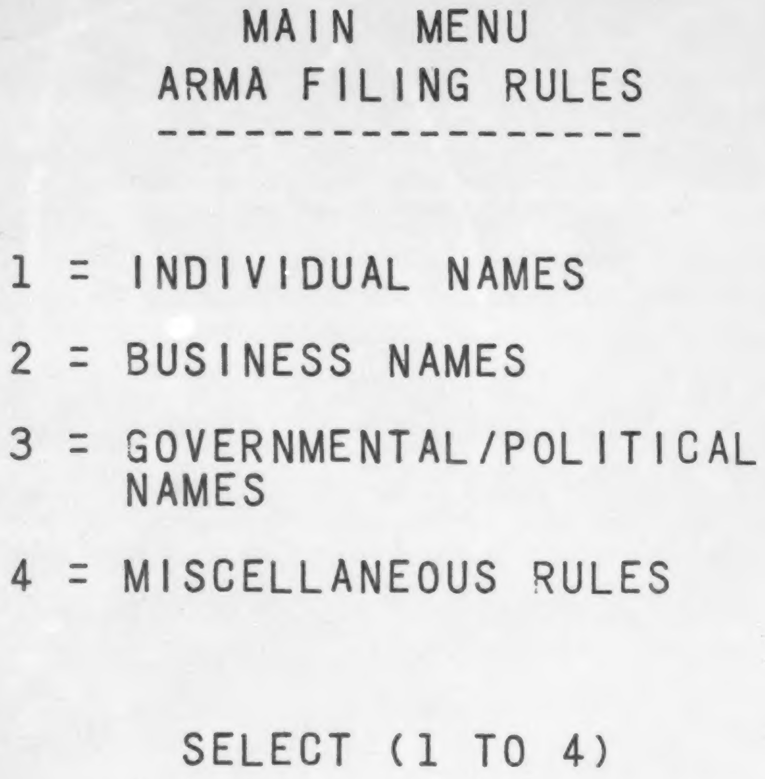
This CAI program has been designed by educators for use in educational and business situations. When developing the program, they adhered to seven CAI instructional procedures: (1) gaining attention, (2) stating objectives, (3) providing direction, (4) reviewing prerequisite material, (5) presenting information, (6) providing practice, and (7) assessing learning. The features of the filing rule "teaching" program as they pertain to these seven procedures follows.

Gain Attention. Students are provided with the title and the relevancy of the program through the use of graphics, sound, and their own interaction with the computer. The computer interacts with the students and uses their first name when responding to them.

State the Objective. General objectives have been developed for the entire computerized filing rules program. Specific objectives for each section of the filing rules are given as the student begins each section. One objective states that "students should be able to correctly answer at least 90 percent of the test questions" given on the final test at the end of the "instructional" program.

Provide Direction. The program assumes that the student knows nothing about microcomputers. Specific instructions are given throughout the program to help students understand what is required. Throughout the entire program, the computer instructs the students which keys to press to access needed information. Figure 1 illustrates the main sectional menu used throughout the program and what the student needs to type to access certain sections of rules.

Figure 2 illustrates the menu to section number one of the rules. Students are allowed to choose which rules they would like to study. However, for first-time students it is suggested that they follow the predetermined pathway which leads them through the rules in a logical progression. For easier reading, each time the student chooses to review the instructions the computer slows the screen output so that the letters appear at a slower pace. This allows the student time to sit and read the instructions. After working through the instructions and instructional program once,



```
   MAIN  MENU
 ARMA FILING RULES
 -----------------

1 = INDIVIDUAL NAMES

2 = BUSINESS NAMES

3 = GOVERNMENTAL/POLITICAL
    NAMES

4 = MISCELLANEOUS RULES


     SELECT (1 TO 4)
```

FIGURE 1

```
SECTION ONE - INDIVIDUAL NAMES
------------------------------

1 = SIMPLE NAMES

2 = NICKNAMES

3 = NAMES WITH PREFIXES

4 = HYPHENATED NAMES

5 = TITLES AND DEGREES

6 = GUARDIANS, RECEIVERS, ETC.

7 = FOREIGN NAMES

8 = SEE MAIN MENU

9 = END PROGRAM


       SELECT   1 TO 9)
```

FIGURE 2

the students will know how the program functions and will have to refer to the rules only minimally hereafter.

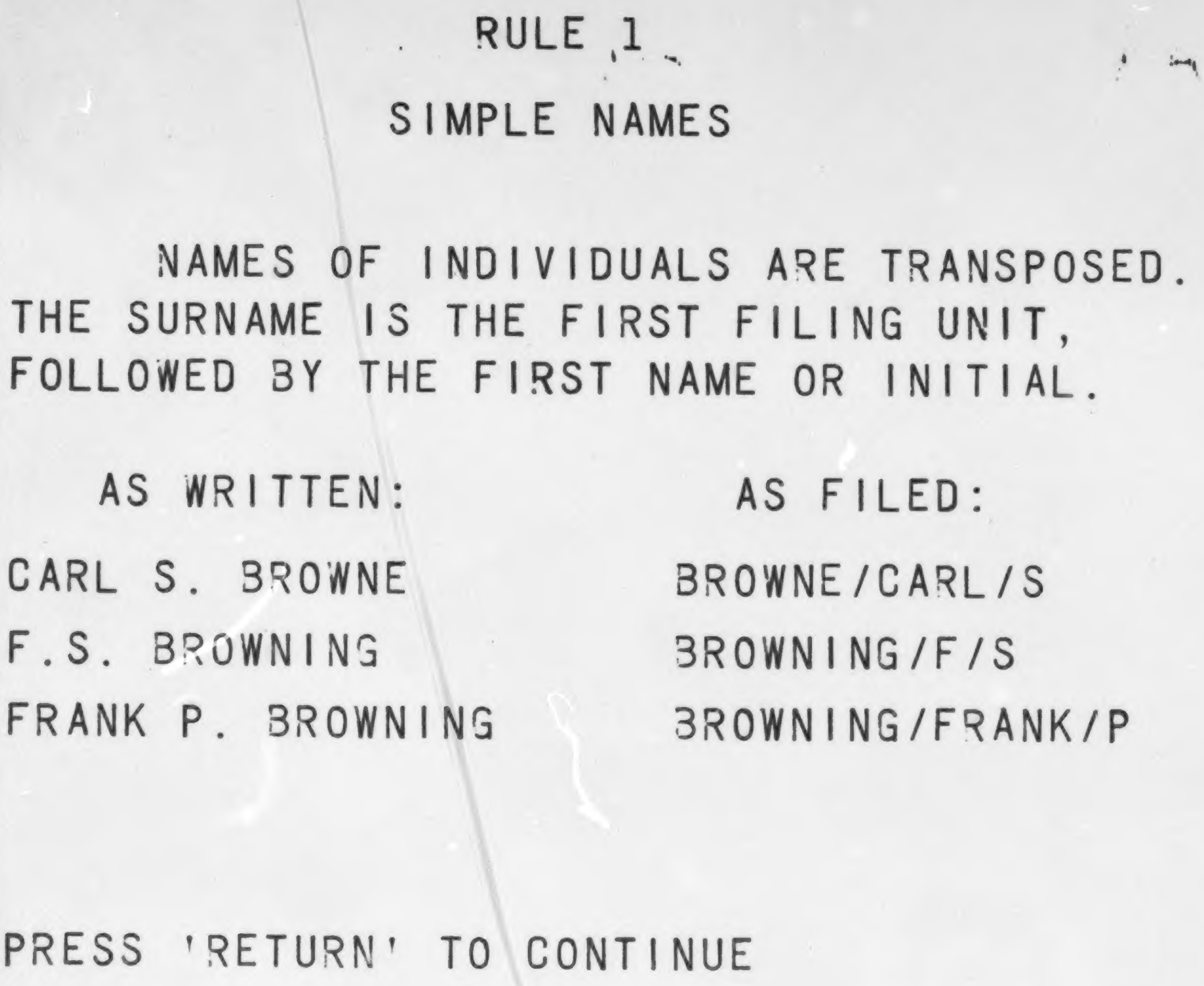
At the beginning of each section of the filing rules, the students have the option of seeing the objectives and instructions if they so desire.

Review Prerequisite Material. At the beginning of the program, students are asked whether they have read the introductory pages of the ARMA publication Rules for Alphabetical Filing. If they have, they will continue with the instructions. If they haven't, they are temporarily directed out of the computer program with specific instructions to read the pages indicated.

Present Information. From the main menu (Figure 1) the student will be lead to the section of their choice. The sectional menu, which delineates each of the individual rules in that section, will appear on the screen. Students are instructed to select a rule. First-time students are instructed to follow the rules beginning with section one and ending with section four.

Each rule is displayed followed by examples of the rule directly below it. The example displays the names first as they are normally written followed by the same names listed in their appropriate filing sequence (Figure 3). After studying a rule and example, students are given a three-name problem. They must arrange the numbers of the names in the order they should be filed (Figure 4). If the students successfully input the numbers and solve the problem, they are praised and are then asked to continue to the next rule--or to exit to the sectional menu.

If the students input the numbers of the names incorrectly, the



```
                    RULE 1

                 SIMPLE NAMES

     NAMES OF INDIVIDUALS ARE TRANSPOSED.
THE SURNAME IS THE FIRST FILING UNIT,
FOLLOWED BY THE FIRST NAME OR INITIAL.

   AS WRITTEN:                AS FILED:

CARL S. BROWNE             BROWNE/CARL/S
F.S. BROWNING              BROWNING/F/S
FRANK P. BROWNING          BROWNING/FRANK/P



PRESS 'RETURN' TO CONTINUE
```

FIGURE 3

```
TYPE THE NUMBER OF EACH NAME IN THEIR
PROPER FILING ORDER.  HIT 'RETURN'
AFTER EACH NUMBER.

1.  ANNA J. ROSE
2.  A. JANE ROSE
3.  ANN ROSS

ANSWER?
?3
?1
?2
```

FIGURE 4

rule will then again appear on the screen repeating the same example. Students are given the same problem and are asked to input the numbers of the names again. If correct, they are praised and will then continue or exit the program. If incorrect a second time, the computer will list the names and numbers in their correct filing order so that students may find their mistake(s). They will then continue to the next rule or exit to the section menu.

Provide Practice. Practice is provided after each rule is presented. Additional drill and practice can be provided by worksheets distributed by the teacher or available aside from the computer.

Assess Learning. Upon completion of all the sections in the program, students access the "testing" program on a separate diskette available from the teacher. The "testing" diskette allows each student to take up to three different 40-problem tests which encompass all the rules previously learned on the instructional program. The "testing" problems follow the format previously used on the instructional diskette. (A detailed description of this important classroom management tool is given later in this article).

Research Conducted

This computerized method of teaching the filing rules is very effective. The computerized drill and practice program has advantages which are important in training students for work in offices.

A research project conducted by Mellanie Herbert, utilizing computerized drill and practice to teach punctuation rules, led her to conclude that:

> Equal student achievement results through microcomputer-assisted instruction have encouraged examination of many other variables of this instruction. Several of these considerations are (1) computer familiarity and student self-confidence in operating computer, (2) pleasureable learning experiences to potentially increase motivation, (3) the saving of class time as well as teacher's paper grading time, (4) flexible schedules for absence makeups, and (5) individualized instruction for different learning abilities and goals." (2)

This computerized method of teaching the filing rules has proven to be effective. The instructional program was used as an action research project, by the author, in an Office Procedures (Office Management) course at the University of Nebraska-Lincoln during the Fall semester, 1982. Of the 36 students in the course 18 were randomly selected to use the computerized program coupled with the ARMA publication, Rules for Alphabetical Filing. The control group studied solely from the publication. Both groups were given a form to record their time spent in studying for the test. The students were given four weeks to complete their studying and were then given a 40-problem test. Results of the test showed that there was no significant difference between the control and experimental groups in terms of mean score. The experimental group spent an average of 2 2/3 hours learning via the computer and 2 1/2 hours studying from the text. The control group spent an average of 4 hours studying from the text.

The University of North Dakota-Grand Forks has utilized an individualized approach to teaching the ARMA filing rules for several years. A slide series was developed that follows a similar procedure used in the computerized program. In-class time is then spent teaching other fundamentals and applications of records management. The filing rules are learned on the students' own time, and they are tested as a group during one class period. Students must achieve at least a "C" grade on the exam (90 percent). They may retake similar exams several times if needed either to achieve a C grade or to better their grade from a C to a B or an A.

Field-Tested

The computerized filing rules programs have been field tested/reviewed at the secondary, community college, and university levels. The program has been changed based on these student and teacher evaluations.

The Testing Program

When the original instructional program was first designed, the testing was to be done during one class period as a group. Because students learn at varying rates, because of the competency-based nature of the grading, and because the computer is more efficient in handling detail, a testing program was developed. Further investigation by the author led to the following CMI (Computer Managed Instruction) program being developed for the benefit of both the teacher and the student.

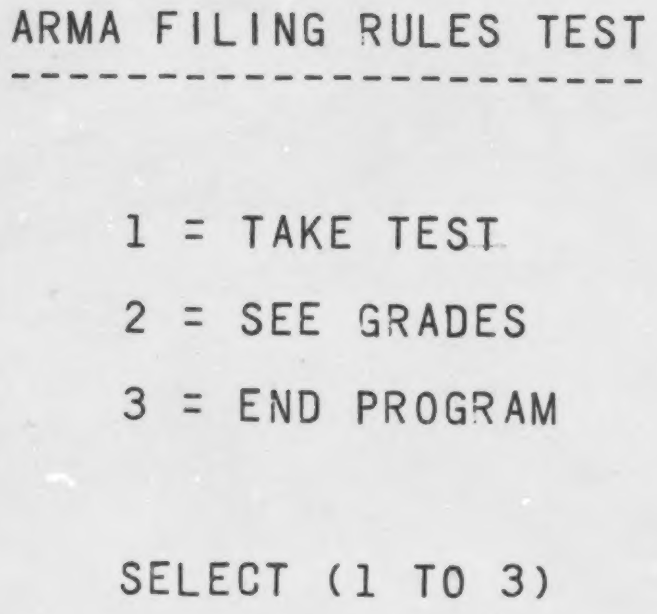
The Student Menu. the students benefit from the testing program in that they can take the test over the rules when they are ready. Just as in the teacher-administered situation, the student is only allowed to retake the test two more times. But instead of the teacher managing the student grades and retakes, the computer manages this administrative detail.

The main menu of this program appears in Figure 5. The first choice lets the student take/retake the 40 problem filing test. Testing will be completed only upon the successful entry of the student into the program--via their own security code (name and number). Instructions for taking the test are included at the beginning. If they want, the students may choose either to review the instructions and grading plan or enter into the test. Before reaching the test, the students will be shown their score(s) on previous attempts and will be reminded of the minimum compentency needed as well as how many tests they have left to meet the minimum score.

The test is designed exactly like the problems presented in the instructional program (see Figure 4). However, students must work through the entire 40-problem test before receiving feedback on their numerical and percentage scores. If any problem(s) are answered incorrectly, they will be brought to the screen for the students' review. The student will be allowed one more look at their test score(s) before ending the program.

A test bank of 160 different problems is included on the diskette. The program is designed to randomly select 40 different problems.

The students must see the instructor if they haven't reached the minimum (90 percent) competency in three tests. The program will not allow access to the test if they've taken three tests.



```
ARMA FILING RULES TEST
----------------------

     1 = TAKE TEST

     2 = SEE GRADES

     3 = END PROGRAM


     SELECT (1 TO 3)
```

FIGURE 5

The Teacher Menu. To utilize the teacher-related features of the testing program, the teacher must select "4" on the main menu (Figure 5). This will bring the teacher into a "password" situation. This security system allows the teacher to enter a six item alphanumeric code. The program allows two chances to enter the correct password. After that the program will end.

Upon successful entry of the password, the teacher will see the following menu (Figure 6). A brief description of each menu function follows. The "create student file(s)" section gives the teacher the opportunity to construct a file for each of the students who will use the CMI testing system. This section also gives specific instructions to the teacher in developing these files.

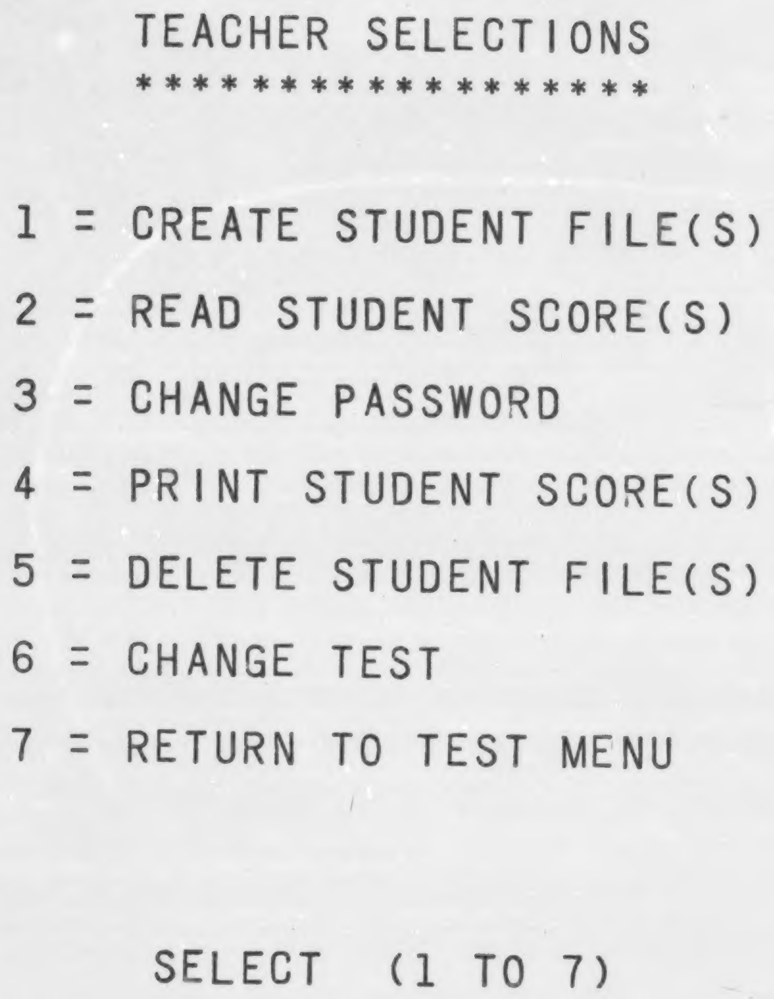
The second menu item, "read student file(s)", allows the user to verify or read one or all student's file(s).

For security reasons the third menu item, "change password" is included. It is recommended that this be changed frequently in order to keep the student files accessible to _only_ the teacher.

Option four from the menu allows the user to print individual student scores or all student scores. The format for output is in report card style giving the name, student number, date, test scores, final percentage grade, and final letter grade. This output can be given to each student or can be used as a backup to the diskette.

"Deleting student file(s)" allows the teacher to clear the diskette for the entry of new student names.

The sixth option, "change test", gives the teacher access to



```
     TEACHER SELECTIONS
     ******************

1 = CREATE STUDENT FILE(S)

2 = READ STUDENT SCORE(S)

3 = CHANGE PASSWORD

4 = PRINT STUDENT SCORE(S)

5 = DELETE STUDENT FILE(S)

6 = CHANGE TEST

7 = RETURN TO TEST MENU


      SELECT  (1 TO 7)
```

FIGURE 6

the 160-problem test bank and allows them to change any or all of them.

Option seven simply allows the user to return to the main (3-item) menu that the students access.

Curriculum Considerations

The main objective of the ARMA Filing Rules Program is to teach the student a standardized set of filing rules in a problem solving format. Emphasis is placed on students learning and becoming familiar with the rules via a microcomputer (CAI/CMI) approach. Many teachers emphasize practice sets to give students a realistic, simulated experience. With the cost of practice sets increasing, it is becoming more costly to purchase these sets each year. Incorporating these programs into your course(s) will allow you more time to teach other aspects of the course and will also allow for individual differences in your students. One advantage of using this software is the curriculum flexibility allowed.

The teaching/testing programs can be organized and incorporated into a variety of classroom situations at either the secondary or post-secondary levels with or without practice sets.

Secondary Schools. At this level the programs could replace a single filing course that had previously incorporated a practice set. The software could be used in a rotation plan in Office Procedures, Office Machines, Secretarial/Clerical Practice, or wherever filing is currently taught. If practice sets are used in conjunction with these programs, the teacher is cautioned that adjustments will have to be made in the practice sets because they do not utilize the same set of filing rules.

Post-secondary Schools. At this level, the programs are well suited as an individualized activity--outside of class--in any of the following courses: Office Management, Records Management, Filing, Secretarial/Clerical Procedures, or Office Machines. Students learn the rules within a 3-4 week period, at times that are determined by the student's schedule. They can also form small groups (2-3 students) to review and discuss the rules. The testing can be handled in one of three ways: (1) They can take all tests and retakes via the computer; (2) The students can be tested via a paper/pencil test with retakes on the CMI program; or (3) The students can be tested via a paper/pencil test with subsequent retakes on paper/pencil tests.

Conclusions and Summary

Almost every business education teacher should be able to take advantage of these programs. They are designed for ease of implementation into the classroom. The CAI/CMI programs utilize the computer to interact with the students, to provide immediate feedback, and to ease the recordkeeping burden of the teacher. They meet specific goals and objectives; are educationally written, designed, and programmed; and are user friendly. The programs are also cost effective in terms of student/teacher time savings. The programs include documentation for the teacher in the form of an instructor's manual--which includes a student/user handout and a "hard-copy" of three different tests to be used in paper/pencil group testing situations.

The time is right for YOU to start incorporating the computer into your business education classroom.

REFERENCES

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2. "New Microcomputer Teaching Competencies", Judith Lambrecht, Balance Sheet, March 1982, pg. 235.

3. "Microcomputer-Assisted Instruction: Equal May Be Better", Mellanie Herbert, Business Education Forum, February 1982, pg. 32-33.

BRIEF BIOGRAPHY

Craig A. Agneberg is an Instructor for the Division of Business Education at the University of Nebraska-Lincoln. He is a graduate student in the last year of his Ed.D. program.

THE ARMA FILING RULES

INSTRUCTIONAL PROGRAM

SYSTEM SPECIFICATIONS AND REQUIREMENTS

PROGRAM TYPE: TUTORIAL/DRILL & PRACTICE ON FILING RULES

SUBJECT AREAS: BUSINESS EDUCATION

COURSE AREAS: OFFICE PRACTICE, OFFICE PROCEDURES, RECORDS AND/OR OFFICE MANAGEMENT, AND FILING

GRADE LEVELS: 9-12 & POSTSECONDARY

PROGRAM USES: LEARNING "ARMA" FILING RULES

SYSTEM REQUIRED: APPLE II PLUS - 48K

DOS VERSION: 3.3 (OR CAN BE ADAPTED TO 3.2)

AVAILABILITY: SUMMER/FALL 1983

PROGRAMS IN THE SYSTEM

SECTION ONE: THE INDIVIDUAL NAME RULES ARE COVERED

SECTION TWO: DIVIDED INTO THREE PARTS AND EACH PART DEALS WITH BUSINESS NAMES

SECTION THREE: GIVES RULES DEALING WITH POLITICAL/GOVERNMENTAL AREAS

SECTION FOUR: COVERS RULES WHICH DON'T FIT INTO ANY OF THE ABOVE CATEGORIES SUCH AS ADDRESSES, SCHOOLS, LIBRARIES, AND NEWSPAPERS

THE COMPLETE PACKAGE OF SOFTWARE WOULD INCLUDE THE FOLLOWING:

(1) TWO DISKETTES--ONE CONTAINING THE LEARNING PROGRAM AND THE OTHER INCLUDES THE TESTING PROGRAM.

(2) AN INSTRUCTOR'S MANUAL WITH DETAILED INSTRUCTIONS FOR BOTH THE TEACHER AND THE STUDENTS.

(3) A COPY OF THE ARMA FILING RULES MANUAL DISTRIBUTED BY THE ASSOCIATION OF RECORDS MANAGERS AND ADMINISTRATORS.

FOR MORE INFORMATION CONTACT:

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CHRIS GROSS-RHODE
RR 3
NORTH BEND, NE 68649
(402) 568-2374

THE ARMA FILING RULES

TESTING PROGRAM

SYSTEM SPECIFICATIONS AND REQUIREMENTS

PROGRAM TYPE:	INDIVIDUALIZED TESTING OVER THE FILING RULES
SUBJECT AREAS:	BUSINESS EDUCATION
COURSE AREAS:	OFFICE PRACTICE, OFFICE PROCEDURES, RECORDS AND/OR OFFICE MANAGEMENT, AND FILING
GRADE LEVELS:	9-12 & POSTSECONDARY
PROGRAM USES:	TESTING ON THE "ARMA" FILING RULES
SYSTEM REQUIRED:	APPLE II PLUS - 48K
DOS VERSION:	3.3 (OR CAN BE ADAPTED TO 3.2)
AVAILABILITY:	SUMMER/FALL 1983

PROGRAMS IN THE SYSTEM

SECTION ONE:	TESTS STUDENTS OVER THE ENTIRE SET OF RULES. THE TEST IS COMPLETELY RANDOM FOR EACH STUDENT AND UTILIZES A TEST BANK OF 160 DIFFERENT QUESTIONS. EACH STUDENT HAS THEIR OWN GRADE RECORD IN THE COMPUTER WHICH COMPUTES AND STORES THEIR GRADES ON EACH OF THE TESTS.
SECTION TWO:	ALLOWS STUDENTS TO SEE THEIR PREVIOUS SCORES ON THE TESTING PROGRAM.
SECTION THREE:	THE **TEACHER** SELECTIONS ARE INCLUDED IN THIS SECTION. THE SELECTIONS INCLUDE CREATING, READING, PRINTING, AND DELETING STUDENT FILES, CHANGING THE PASSWORD, AND CHANGING THE TEST QUESTIONS.

THE COMPLETE PACKAGE OF SOFTWARE WOULD INCLUDE THE FOLLOWING:

(1) TWO DISKETTES--ONE CONTAINING THE LEARNING PROGRAM AND THE OTHER INCLUDES THE TESTING PROGRAM.

(2) AN INSTRUCTOR'S MANUAL WITH DETAILED INSTRUCTIONS FOR BOTH THE TEACHER AND THE STUDENTS.

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Home is the Computer

INTRODUCTION

By Mildred Luckhardt

In the quiet living room, the father sat in front of a long, narrow, low table. He sat as a king might sit--on a throne with his subjects coming to him with supplications. This new "king" used the machines on the table in front of him to help his family with their individual problems. His son had used the machine to produce a homework assignment. He now needed to check the spelling and hyphenation of his paper. Father did it in a few seconds with his machine.

The wife needed to record and average the grades of her math students. As she read the grades, the father typed them and the machine averaged them and printed the results. With the dialing of a phone number and a few simple operations, the father looked at the computer work his daughter had done at a nearby university.

The computer in this home had changed the living room of this family and the family behavior. No longer were the evenings spent staring at the TV. Now the machine had created a world where information was readily available, where routine tasks were performed with ease, where the focus of attention had shifted from watching TV to operating the computer. The year and place? A small town in Texas in 1981.

Across the U.S.A. and in many other countries, the beginning of the decade of the personal computer was at work. The scene was not an ordinary one for that year, but was just one manifestation of how many people were adopting and adapting the age of the microcomputer to their own use. The computer had shrunk from it's inception as a large, room-sized machine costing a half million in 1948 to the table top version used in the Texas home costing less than three thousand dollars. In 1982 Time magazine chose the microcomputer as the "machine" of the year. By the end of the 1980 decade, Americans will have incorporated computers into their homes and lives.

Such a development is not without precedent. It was a mere 60 years between man's first flight and his first step on the moon. It was only 10 years between the first commercial radio broadcast in Pittsburgh ,1920, and the nightly Lowell Thomas newscast heard in every American home in the 1930's. TV followed a similar pattern of adoption by the public. Ten years after installation of TV stations in major cities, most families had bought one or two TVs and family entertainment had changed dramatically.

For home economists, the advent of microcomputers as a home appliance is an exciting challenge. Many professionals in the field have already recognized that computers are a part of everyday life. Everyone has had contact with computers in one way or another since the 1950's when the first computerized U.S. census was done on that first gigantic, 18,500 vacuum tube machine (Moody,1980).Improvements in the machine increased its use by industry, government and the schools. School records and schedules,payrolls, purchasing, stocking and billing, inventories and checking out groceries have become computer operations. Newspapers and magazines set type by computer. Credit card purchases have been made possible by the use of the computer as have airline reservations. Phone bills and phone calls are processed by computer. Dentists, doctors and hospitals are all dependent upon computer power. In fact, without this amazing tool our lives would be very different. The telephone company used to claim they would have had to hire every "woman" high school graduate to "mann" their switch boards if calls were still done manually. Today's woman would label the remark as sexist. We would still be on a "cash" basis in most of what we buy. Plane tickets would be processed so slowly that the industry could not operate. Grocery check out lines would be even longer. Mistakes in making change would be greater. The business world would be very different from what it is today. Every check written in the entire nation is processed by computer. (Denkin, 1981) College registration would be a throw back to long lines. Those home economists who work in the business world have learned to read the printouts, to function with computer information without touching a computer. The new age of the personal computer will demand more of us all.

RATIONALE FOR COMPUTER USE BY HOME ECONOMISTS

The personal computer now being acclaimed as the foundation of"Third Wave" society by Toffler and others will, within the decade, produce startling results in our personal and family life. For home economists in many fields this will be the new challenge. Those who teach at the high school or college level will either willingly join the majority of educated consumers of the new technology or will be swept aside by the computer revolution. If they remain uninitiated or illiterate, they will not be able to function in their jobs as educators--especially as educators about homes and their management. Home economists, for survival, must quickly catch up to those who already have developed computer applications for personal use. Home economics educators must be on the forefront, too, of keeping consumers informed on some misuse of the computer, of uncritical acceptance of answers generated by a computer program.

In the home of today, the microcomputer chip is already at work in many of our appliances. The "programmable" microwave oven is the most obvious one. But there are central logic devices which can help keep time and simultaneously direct all types of electrical devices in the home; such as, lights, furnaces, solar panels, airconditioners, burglar systems, etc. Home grocery lists, freezer inventory, home inventory, time management, all correspondence, addresses, budgets, bank statements, and connection with a world of others through The Source or Compuserve are already part of the home computer management of many homes. While other businesses fold and disappear from the scene, the home computer business is breaking records. There are automobiles that tell you when to check the oil, how fast you are driving and even remind you about fastening you seat belt as well as regulating spark plug timing and fuel injection.

EDUCATIONAL APPLICATIONS

For home economic educators involved in the new technology, there may be no glamorous overnight million in sales or a rise to the top of the Dow-Jones. Home economists will most likely be those who teach about this new wonder machine as an appliance. They will teach the "hows" and "whys" and "what ifs" of this appliance; its application in everyday life. This has been their traditional role; not inventing, not promoting, not selling, just applying knowledge from all fields in ways that can help individuals and families.

Just what will the impact of computers in homes be? We've already looked at one family, but generalizations will eventually be made by what many families do with computers and what computers do to families. The four million Americans who bought computers in 1982 may find their own way or ways of using them.

EARNING WITH A HOME COMPUTER

Others before them have had particular jobs in mind when they purchased their micro. Some have used them for wage or profit making from their homes. This certainly might include the farmer or rancher who now keeps records of flocks or herds, of feed costs, or tractor repairs (Time, Jan.1,1983). Some women are working as programmers at home, tending to their children between stints in front of the CRT (cathode-ray tube or screen). Some families of wage earners in the computer industry have become users because the computer invaded their home (Parr,1982). When husband and children spend all of their spare time computing, mother either joins or gets left out. Many families want to use the computer for a feeling of interest, of togetherness. Each member finds programs that are of use in their lives.

AS A HOME APPLIANCE

The future use by families can be seen by the kinds of programs already available for home managers. Most people will not be programmers. They will use commercial programs already written. There are many already. Every computer company has a program for word processing, which allows you to use the computer to compose letters, write articles or memos and then print the message. The real joy for the typist whose skills are poor is that all corrections can be made on the computer. Words, sentences or paragraphs can be inserted, deleted or moved around without retyping. (The real problem comes when you save the program under the same name, the power goes down or you forget to save!) Words can be checked by another program. It can be reprinted at will. Some of the names of these programs are Wordstar, TIwriter or Superscripsit.

Routine tasks for home, such as record keeping, may make it possible for mothers to stop apologizing for the condition of their recipe files. Not only will they be ready for instant printing; but, they will be simple to find. That special recipe from a newspaper 17 years ago with its yellowed paper and frayed edges will be history. The same will be possible with addresses or phone numbers. No losses, no slips under the drawer or Christmas card lists left for the dog to chew. Programs such as Profile for e TRS-80 or Mailing List for the Texas Instruments are examples of programs that can be used for these tasks.

Routine letters can be written easily and the spelling checked in seconds by using the Dictionary Program. Some inventories can be placed on a disk and put into safety deposit boxes. Tax returns can be done with Tax III which is updated every year and can be obtained from Rockwell in Dallas TX. Check balancing will be possible for those of us who abhor the process (Moody, 1978 pg 88).

It is already possible to use a light pen and a grocery program to prepare a shopping list according to the aisle arrangement of your supermarket. The light pen comes from 3G Company, Inc. Rt. 3, Box 28A, Gaston, OR 97119. Time Manager Program (TRS-80) sees that no birthdays, meetings or anniversaries are forgotten. This is a Tickler file supreme. With Visicalc, a spread sheet, calculations impossible before, now make keeping track of expenditures, bank accounts, and investments a possibility at home. TI has programs called Home Financial Decision, Household Budget Management, Personal Record Keeping, Personal Real Estate, Personal Financial Aids, Tax Investment Record Keeping. Other computers have similar programs listed. All have application to homes.

There are even wider applications if you have a modem (an attachment to your micro which uses the telephone lines to connect you with main frames or large services). Access to this information can increase knowledge used in decision making. Some main frame programs have already been converted for use on micros. "Dollar-stretcher" or "Dollar Watch" compares your expenses to those of a similar family. Leaks in the budget can be found or your spending habits analyzed for decisive action by you (Plano Daily Star-Courier, Sunday April 11, 1982). Michigan State's Teleplan has programs which can quickly calculate and compare the cost of buying plastic liters of cola to buying the carton of glass 12 ounce size for a family for a year, for example. Even looking at the difference between buying a 20 ounce loaf of white bread vs. the specialty bread over 52 weeks is a revelation to the family shopper. Information for decision-making is a key to one of the true values of the microprocessor for home economists.

For a small charge you can get on a network by using you modem and telephone connection. One such network is called The Source which is located in McLean, VA. but is a local call in 300 cities in the U.S. There is an initial fee of $100 and a monthly charge of at least $10 to use the service. Included in the services is information about airline schedules, hotel, car rental and airline reservations, bargains to buy, ways of selling your items, or where discounts can be gotten on name brand products. You can contact real estate agents, play games, or use statistical packages to analyze data. The news of the world through United Press International is at your finger tips or you can contact others on the network through their mailboxes. CompuServe from Columbus, Ohio is another network which provides some of the same services and is less expensive, but considered more reliable (Willis and Miller, 1983,pg 74).

Some programs are designed to eliminate myths held as truths. If you want to understand just how much it may cost to own a home or rent it, for instance, one program will calculate 23 variables within minutes. You can change the variables and really look at the true costs of owning compared to renting rather than make a decision based on an old saying. Before, you could only do the calculations by spending hours with a calculator, so it was not done and the myth was repeated often enough to become acceptable practice. Now by changing one or two variables,such as, years planning to stay, income bracket for taxation, interest rates, closing costs or future sale price of the house, instant calculations are possible and decision making is based on calculated risks rather than repeated generalizations (Luckhardt, 1982).

Should you insulate the attic? What's the payback period? Is solar energy viable in your location? Perhaps you are really serious about dieting? Some programs will give you your recommended caloric intake for your weight, height, age and activity. Some menus will be suggested and each day's intake can be totaled. A graph of daily calories will also be produced for you. You will still be the decision maker in all of these operations,but individual information given in such great detail was not available before except through laborious calculations which few did (Dillon,1982).

The Peters of Waterloo, IA have two programs on window treatment. One will calculate the energy savings of an installation while the other will estimate yardage and pleating.

THE COMPUTER AS A CLASSROOM MANAGER

As an educational tool, the microcomputer seems like the missing link to the educator who dreamed that learning should be exciting for everyone on an individual basis. The dream of the open classroom waned when teachers tried to implement individualization without teacher aides, special curriculum materials or the environment of the "Oak Leaf School".

Home economics teachers always did a great deal of individualization in their laboratories, but when they were directed to place each student in a clothing construction class at their own level and permit each one to pursue the level of their competence, teachers were unable to determine just what each student could really do. Self report on what a student could produce and at what level of excellence was not successful. Paper and pencil tests on machine threading or operation proved invalid. Student interest certainly was greater when they could work on any pattern and any type of fabric according to their abilities, but classroom management became ponderous, if not, impossible. Even with the use of single concept loops to review construction techniques for individual students, the wide range of instruction needed was greater than one teacher could handle. Can computers give home economists that kind of help?

Not only was testing each student for their level of competence impossible without good tests for measuring, but keeping records for the hundred or more students passing through the classroom daily posed an insoluble problem. Production of mountains of papers and control of student competencies may now seem to be possible with the help of computer programs even though laboratory assistance is but a dream. Grade averaging, record keeping and even judging the readability level of texts is now possible. One program makes it possible to type all test items but once. It stores them for instant retrieval and rearrangement with a test key reprinted each time. Test items that prove to be poorly worded can be dropped. The difficulty of items can be judged and categorized for use. This program alone would eventually save hours of teacher time (Test Bank from Advanced Technology, Tambor Court, San Diego, CA 92124).

There have been computer managed records used by schools for some time. Carnegie Mellon University completed a study of the use of computers in education in Pennsylvania. Ninety-three percent of the districts used computers for managerial purposes, but teacher use of computers was low. Only five percent of the teachers were using computers by 1981. Although that was an eightfold increase in five years, the math teachers were still found to be the most influential teacher in starting the use of the computer in instruction with the science teacher and some English teachers. Home economists were not mentioned (CMU,82,P.7).

Another disheartening fact emerged from this study showing that higher income districts use the computer more often to teach programming skills than do low income school districts. This was considered as giving those students an advantage, particularly once in college. Since CMU was the first university to announce that entering students by 1986 would be expected to bring their personal computer with them, this conclusion may be biased. Biased or not, the standard has been drawn and even home economics students will need to be computer literate.

THE COMPUTER AS A LEARNING TOOL

In a short time , pre-kindergarten children who play

Atari games or who are being taught Logo will be in high school classes. If home economics is to educate them efficiently and effectively, computer assisted learning must occur as well as computer managed instruction. All of the programs mentioned earlier in this chapter are certainly programs that could and should be used in home economics classrooms. Such programs help students understand decision making using information. Problem solving with nutrition information would be possible with the use of the nutrition program which prints out the Recommended Daily Allowance figures for an individual and gives a summary of the percentage of RDA acquired from the food eaten that day. Students would gain insight into food nutrients and their relationship to health without laborious calculations. In fact, the difficulty of calculating such figures has prevented its use in classrooms to a large extent. With this detailed information, students could become better shoppers and eat more nutritious food rather than become fooled by food fads (PCD Systems, Inc.).

Vocational home economics teachers may find another dimension can be added to their occupational curriculum. Cottage industries are reviving . The design, production, distribution and sales of boutique items--hand made--fits the home economics criteria for occupational teaching, home skills used for wage earning. The entrepreneurship for organizing and managing such a business can be taught by the business or DE department in the school, but this dimension combined with home economics skills provides students higher goals. (Graduate Student,1982) Such goals can give direction to entry level jobs in factory or business. With the use of simple programs, students can learn how to keep track of purchases, etc. The computer can provide the extra brain power needed to produce a successful, small enterprise. For some students logging in the data of items on home inventory disks, or updating home files, may provide a service for affluent home makers. Certainly management of large estates and large households will require computer skills of household help in the future. Home economists can help student become home managers for hire.

Physical exercise programs can be planned, monitored and even menus can be designed for specific diets (Younger,1982, pg.57).One program for evaluating meal planning for cost, eye appeal and nutrition would help to teach meal management. These programs can give information for problem solving and provide students the autonomy that teenagers seek, but are often denied. (VocEd, Apr.1982)

DRILL AND PRACTICE

There are some possibilities for programs in home economics which are drill and practice as long as a book or other media cannot do the job better. Programs which can repeat ad infinitum facts which students need to memorize have a place in any classroom, but the availability of computers might limit this use. Ten minutes a day per student will not get the job done. More than one computer to a classroom may be needed for this type of work.

While drill and practice on measurements, on servings, etc. would not warrant a computer for all classrooms in home economics, one in nutrition classrooms or in clothing construction rooms for designing and changing patterns may be reasonable.

COLLEGE APPLICATIONS

For the home economics departments in universities, micro computers are a necessity. There, the faculty is most vulnerable if they are not computer literate. Within ten years, students now in elementary schools, where computers are most abundant, will be entering college classrooms with enough computer background to use the computer as easily as the teachers use a chalkboard. Faculty in fashion merchandising, textiles and clothing construction need only adopt or adapt what business and industry already are doing with main frame computers. Business applications, textile test comparisons, stain removal tests, clothing design and pattern sizing are all good candidates for micro applications. Most have already or are in the process of being done. Putting together a fashion show with a musical score from a computer and lights operated by another one is a possibility and in keeping with Punk fashions of today.

The ability to analyze a patient's diet is already on hospital computers. Future dietetians can use micros for simulating their future role. Nutritional programs of all kinds are now in use on many kinds of microcomputers: TRS-16, Eagle II, IBM, Apple, TRS-80 III and TI. Some are for professional nutritionists and some for educational purposes. The professional programs cost in the thousands while some of the simple programs are only forty dollars. The very expensive programs are used to generate income and profit through nutritional counseling. Not all of them are based on nutritional practices considered ethical. Some are used in a manner that makes the job of the dietitian easier through rapid calculation of difficulty and complex items. Before purchasing a demonstration would be in order. Some of the more interesting ones are: The Nutrition Consult from P. O. Box 1513, Norman OK 73070 or Nutriplanner, 1600 system from Practorcare Corp., 11675 Sorrento Valley Rd. Suite H, San Diego CA 92121 or Computrition, Inc. 21021 Devonshire St., Suite 201, Chatsworth CA 91211. For a complete bibliography see, COMPUTERS IN NUTRITION, DIETETICS AND FOODSERVICE MANAGEMENT, by Loretta Hoover, Dietetics Education E26 Health Science Center, University of Missouri-Columbia, Columbia, MO 65212.

Housing students have the option to use the computer for furniture design, room layout, or architectural designs. Addresses of supply dealers and client billing are great when computerized for interior designers. Energy audits and rent/own comparison programs are some of the other possibilities.

MICROCOMPUTERS AND THE SCHOOLS

Our educational systems like all institutions, have a certain slowness in adopting an new idea. In 1982 IBM gave support to a project to test an idea that Dr. Ben Wood spawned and tested in the 1930'S--that children of five and six with a vocabulary of 2000 to 4000 words can learn to read better if they are taught to type the words first rather than attempt to read printed words and write script. IMB will sponsor 10,000 children in the new experiment and underwrite the project to the tune of one million dollars. This time the idea may catch on and as Dr. Wood says,"It will probably bring about the most significant revolution in our whole educational system---since it is equally applicable to all alphabetic orthographies, it may ultimately improve education in all nations..." (Wood, Christmas 1982) Home economists may not have fifty years to wait to see if they can become considered effective teachers of life skills. They need to become one of the introductors of the new computer education in their field.

POLITICS OF CHANGE

Few school districts or universities ponder the total effect of many of their decisions. They are more often pushed by public whim or spotlight to do one thing or another. One or two people objecting to some words in a dictionary can excite a community and push action faster than stacks of doctoral dissertations on the benefit of any particular method of teaching. State universities will act as a legislature dictates in spite of evidence to the contrary. As of now, studies on effects of computers on learning are scarce while every magazine and even newspapers print articles written by journalists about the new wonder machine. Computers have caught the imagination of the young through Pac man, invaders or ET games. Adults give approval if students do not have to put a quarter in a slot to use it. High prestige school districts led by California, have acquired hardware and software and sent forth their students to proclaim the virtue and value of the "machine". From Silicon valley has come the invention, by the children who worked on terminals of main frames while still in high school. Such pressure is effective in creating change in schools.

In many institutions the home economics departments or colleges that do not have terminals to a mainframe computer or that do not have a microcomputer on the desk in the office will soon be considered backward, ill-informed or just plain powerless. Just as the business person has placed status on having a computer on the secretary's desk, so have educators equated equipment with progress. They view the presence of the "box" in a department as educational know how. Home economic leaders will have to follow the leaders if power on campus is measured in this fashion.

Buying equipment for the department will be just one small step toward status for the department. Finding funds and processing it through the business office will prove the worthiness of the administrator, but there are some other activities with the equipment which may prove more difficult and require some politicking. If the department wants to train home economics teachers and professionals to use the computer as a home appliance, it would be wise to get the cooperation of the computer science department. In some institutions this will be easy; in others, impossible.

In some schools the philosophy of the computer science faculty will be elitist. They will consider themselves the keepers of the "light", high priests of "computer knowledge". Dr. Willis, author of COMPUTERS FOR EVERYBODY, has an entirely different and more realistic view of the field.

He claims that eighty or ninety percent of the people using computers in the future will be program users or informed users. He describes program users as people capable of turning the machine off and on, running a program and able to deal with minor problems. Skill for this level would require a few days training and home economists would be able to conduct the training.

An informed user, he suggests, will know somewhat more. He/she will know more about what the computer can do. These people will read magazine articles and talk with others about computers. They will purchase machines and they certainly will be the potential market for workshops by specialists in subject matter, including home economists.

Some of the people will be able to debug or adapt a program while, still others, will be expert in one area or one one model or make. Only five percent will be the exhaulted "hackers" who take computer science, know the equipment and programming. They invest a great deal of time and effort in computing. For the home economist, they are important people to know. They can help write the program the home economist needs or translate one program from one operating language to another. Some institutions may have computer centers where such service will be given to faculty. Ideas can be translated into programs for class use, without the home economist trying to become a computer science specialist.

IMPLEMENTING INSTRUCTIONAL COMPUTING

Take Dr. Willis' advice, don't let the elitists intimidate you. Choose your level of expertise. If the politics of a particular institution is not open to the eighty percent of users, learn elsewhere and teach workshops where ever home economists can be trained.

If you want to learn, take courses from manufacturers or invest in a machine of your own. You will soon find others who are enjoying the same process. People network to accomplish the level of learning they want.

Some school districts have written grants which have provided training for secondary teachers. Lyons Township High School developed eight laboratories with 25-30 computers networked in each lab. They also developed a system for training and involving home economics teachers who are reported to use the labs more than any other vocational unit. Their programs were developed with Illinois State University at Normal, IL.

Educational innovation and change have always been difficult, but possible. Wood's expectations for change, held for so long, may be warranted. Seymour Papert's MINDSTORMS conjures an equally exciting view of the educational possibilities using computer power with children. The simple LOGO language developed at MIT allowed grade school children to program and run a "turtle". Through that process, they discovered geometric concepts and how they worked in the world, not just a memorized theorem. Papert cautioned that poor use of the computer in schools can negate its great potential (Papert, 1981).

Dr. Kahn of the Institute for Educational Action Research foresaw the possibility of Ivan Illich's hope becoming true by suggesting that the personal computer may, indeed, deschool American Society (ADCIS,1982).

Once you have learned something about running programs you, too, can become a change agent in your particular school by getting involved with computers. You might want to contact the Educational Product Information Exchange for evaluations on hardware and software, EPIE-Consumers Union, P. O. Box 620, Stony Brook, NY 11790. Creative Computing Magazine, Datapro Research Corporation and Popular

Computing magazine, also, have reviews evaluating hardware. Information sources are getting better for the educators who want them. Equipment is getting better and less expensive.

Promotion of products through the schools is an old game well known to home economists who have had sewing machines, stoves, vacuum cleaners and other equipment placed in their schools for a fraction of their cost or on loan. The public have often thought such equipment was chosen by the home economist and, therefore, must be a good buy. The companies like the system and home economists have used it to get supplies. Some products have not been reliable. Caution in choosing the make of the computer should be used. Microcomputer sales will be as profit oriented and competitive; but good equipment at a price can be had if comparative shopping is done.

One important consideration in getting equipment in schools is the vendor and the service offered. Since there is such a push to purchase, vendors have, to date, serviced those districts with the largest budget. For the user, good service means help with equipment failures, with mistakes made in using equipment and some training of faculty. Of course, educators should do their part by knowing what they need, what to buy, and whom to talk with in the company. Dealers, on the other hand should understand a school or district's purchasing procedures, create sample files, provide support and service (Titus, Jan. 1983) .

FINDING SOFTWARE

FREE OR INEXPENSIVE

Finding software that is free, inexpensive and useful takes time, but it can be done. (Price, May-June 1982). There are five sources of information worth looking at. One is computing magazines. Since people share many common problems in everyday life, programs have been developed by programmers who are willing to share their work. Such programs are in the public domain and require typing them on a disk. The following magazines are examples; they have been listed many other places: Personal Computing, Interface Age, Compute, Educational Computer, The Computing Teacher, Course Ware and 80-Microcomputing.

A brief thumbing through some old computer magazines showed these titles: Home Buying by Computer(Loppen, May 1980); Personal Estate Planning (Buss, Feb,1980); Retirement and the Arithmetic of Inflation (Whitney, May 1980); The Micro Diet (Brothers, Dec. 1977); Your Wallet (McGuire, Feb. 1979). These are just a few. How useful they are is another matter. But titles can be found.

By joining users clubs (groups of people who own and use the same kind of computer), more software help can be obtained. For example, TRS-80 users groups generally buy a membership to LOAD-80 which supplies all of the programs printed in the magazine on a tape. Members share the cost and have the privilege of copying the programs on to their disks. Many are games, a few have interest to the home economist; Grocery list, house inventory and freezer inventory, for example.

Books at computer or book stores contain some programs that you can copy. There will always be some of interest to teachers or some home programs. Some skill may be needed to translate these to your brand.

Another source is from ERIC, NIE (National Institute for Education) or the NSF (National Science Foundation). They have given grants to individuals for development of programs which then become public property. Home economists may not get the grants, but by seeking through the lists some appropriate material can be found.

At conferences there are additional sources of information for the educator seeking software for schools. There are sessions given where such information is shared. Professor Alexander of Illinois State University listed the following micro programs at the AHEA in 1981; Clothing Fiber Care Program; Home Owner's Capital Gain, Measurement Conversion; Nutrition Analysis; Personal Budget Program; Pounds Away, Recipe Analysis; Stain Removal Program; and Utilities Analysis. AHEA had a software display in 1982. AVA had pre sessions in micros in December in 1982. The Wisconsin Vocational Studies Center presented one in August in 1982. Ideas can be found at all of these meetings. The programs have to be tried and evaluated.

PROGRAMS FOR A PRICE

When there is a budget available, there are other sources for programs which may interest the home economist. Home economic magazines are beginning to carry information on new software, sometimes to the surprise of the vendor. Briley Software, Livermore, Ca 94550 has Home Inventory, Grocery Mart, and Dinner's on for VIC and Pet computers. Some information can be obtained from brochures and company catalogs which are sent to teachers or schools. Here are just a few recent announcements. Pleasantville Media of Pleasantville, N.Y. 10570 advertised Computing Your Way to Better Nutrition, Finding Readability Levels, Time Saver, Teacher-created Puzzles and Tests. Addison-Wesly, Reading Ma 01857 has an Energy Monitor Program. The Test Bank program from Advanced Technology Applications, 4296 Tambor Court, San Diego, CA 92124 or the Nutricalc program from PCD Systems, Inc. 163 Main St. P.O Box 143, Penn Yan, N. Y. 14527 are useful programs, but expensive.

A search through any of the computer catalogs given away at computer shows will show that there are word processing programs, spreadsheet programs for calculations, mail or address programs, as well as, time management programs. Most have programs which allow teachers to author their own programs for educational purposes without much computing knowledge. Here are some other titles that were listed and sound interesting: Mortgage, Preschool IQ Builder, Real Estate Listing, Inventory Household Finance I and II, Home Addresser, Grocery Mart, Classroom Management, Checkbook, Careers, Budget Management. That is just a few to look at.

One fast way of learning what is on the market is to attend a computer show. Most large cities like Dallas, Los Angeles or New York as well as medium sized and even small towns across the nation have had shows where vendors bring their equipment, including software, for demonstration purposes. Conference of organizations devoted to educational computing, also have equipment on display. These include the Association for the Development of Computer-based Instructional Systems which has a Home economics special interest group, Association for Educational Data Systems, Human Resources Organization which publishes Academic Computing Directory, by Robert J. Seidel, Microcomputer Education Application Network, Minnesota Educational Computing Consortium, the National Videodisc/Microcomputer Institute. Micro Sift connected with the Northwest Regional Laboratory will also send software information for education to schools.

There is a profusion of courses in learning how to use a microcomputer, but to date few designed exclusively for the home economist. The courses given by the equipment manufacturers, high schools, community colleges and universities can give an individual a good beginning. Courses in home economics departments have the advantage that some software is developed that is of interest to the field. Mary Sue Cole developed "Sneaky Snacker" with the aid of a computer science major enrolled in a workshop at East Texas

State Unversity in 1982.

In fact working with a programmer is also a good way to develop programs for classrooms or other educational settings. Computer centers at universities or other professors, even that high school computer programmer can help. Luckhardt developed "Rent/Own" with the help of Dr. Hackenberg. Some universities will sell such programs for a nominal fee. The University of Missouri-Columbia has six such programs; Cost of Food for a Family; Planning for Saving Goals; Comparing Checking Accounts; Estimating Automobile Cost; Planning Life Insurance Needs; and How Much House Can You Afford? The University of Nebraska at Lincoln has a well regulated program for students using the main frame computer. Some of their programs have been put on micros: Grading, CLO Values for Clothing; Stain Removal Program; and Statistical Analysis. These programs show that schools are moving to supply programs for the profession. Penn State has a nutrition program , Iowa State was developing a menu analysis, Delaware has a pattern adjustment program under way.

EVALUATION OF SOFTWARE

There are certainly enough programs for any home economist to begin to learn to use a computer without computer science or computing skills. Learning to use a word-processor for class handouts, classnotes, writing articles (such as this one), correspondence, or reporting research is a rewarding activity. The results are great. It takes time to learn, but time is saved in the long run. Of course, there are many programs being written not worth the money and some criteria for software for use in classroom should be used.

Before judging software, an individual might want to join a group of teachers such as the Computer-Using Educators(CUE)s which publishes a bimonthly newsletter, sponsors four conferences a year, and supports a library of educational software (Softswap). Softswap can be contacted at San Mateo County Office of Education, 333 Main St. Redwood City, CA 94063 (NICE newsletter, Mar,1982). Softswap has a collection of software, some of which educators can copy and some commercial software for preview.

Many kinds of evaluation forms to rate software can be found. Some simple rules are evident. A program should not be something which can be done cheaper or just as well with paper and pencil. There is one example where a program uses English words to have the student choose whether or not "C" comes before or after "D". It seems highly unlikely that such a program can be used by a child who does not know the alphabet and has not learned to read. One nutrition program had five simple questions, better answered with a paper and pencil than with a computer. Some management by computers in the beginning grades takes more teacher time than if the teacher scored and recorded the grades. In some cases it allows for padding of student achievement. These kinds of programs will eventually not sell, but right now everything is finding a market. Program quality depends on many things: the wording should not scroll on the screen,; the user should be in control of the speed of the presentation; the user should be able to go back or leave the program. Certainly the words should be readable. (The monitor or computer may be the cause of poor visual quality.) Good grammer, correct spelling, hyphenation and punctuation are expected. The user should be able to use an abbreviation for no (N) or (Y) for yes, etc. Incorrect answers should be corrected or at least the program has no right to insult the user. Too much feedback for incorrect answers may have students deliberately trying to be wrong. The program should have a menu, as much internal documentation as needed, ask for one piece of data at a time, require short input and not go into endless loops. Good courseware also has some external documentation including program name, author name and address, copyright notice, target computer, educational objectives, program abstract, teaching strategies, pre-requisites for use of the program, student guides, student worksheets and record sheets. Few inexpensive programs have had this kind of development. Home economist must judge what can be done with such programs or buy more correct ones even though more expensive.

Certainly the information on the program should be correct. At one conference session the entire audience was appalled at the incorrect answers given on a program on child development. "Garbage in, garbage out" is a good rule to remember. Teaching incorrect information should be accidental, not intentional.

The latest software is being deemed user friendly. "User friendliness" is the most talked about topics in the computer industry (Brian Starfire, Jan.9,1983). If "help" screens which can be displayed with the touch of one key, are part of the software, it is "user" friendly. Instruction manual should explain in sequential steps what can be accomplished. Those programs with audio tapes are not useful unless directions are written and the place where the directions can be found on the tape noted.

For those personal computers using CP/M-the one operating system that allows software to be used on more than one system-there is a new software package which uses an English-like series of numbered menus and instructions. CP+ software can be used with all the normal "application" software. Some state-of-the-art software combines multiple functions, allowing word processing, numbers modeling and graphics with a single piece of software. Continuing improvement in the software can be expected in the years ahead. That is no excuse for waiting.

PUTTING PROGRAMS TO WORK

Teachers can be convinced that a computer is a tool that they can use. The quickest way they can learn to use the "machine" is to have an interesting program that they can interact with. In home economics it can be a nutrition program, a weight loss program, grocery list or any kind of interactive program. Typing tutor or a simple spelling game will do.

That first step where hands on experience is positive can be followed by some classroom or in service activity. Vendors can, but many times do not help, with this kind of training. A person acquainted with the subject matter or with teaching problems in general can be of greater assistance for teachers in a particular subject. The administrator seeking to implement microcomputers, needs to involve teachers long before teachers are expected to learn or computers will sit on the shelf unused. Only if teachers see the use of the computer, will it be used in the classroom. Just buying equipment will not produce computer-assisted instruction. Forcing computer managed instruction on teachers can be counterproductive also. In service can be a short half day designed only to motivate or a semester long course given at the site. With short funds this is unlikely, but spending a great deal of money on equipment without planning the cost of training may make a vendor wealthy, but will do little for students or teachers. Some kind of motivational, enthusiastic demonstration and teaching is a necessity. It should be built into the implementation. If the money is saved on this so more equipment can be bought, it may all sit without much sensible use.

Regardless of the length of the training, the trainer must understand that mature students are sensitive. They, like all students, want to have control of their learning, its rate and content. They need constant encouragement and a feeling of success. Any indication that they are not doing as well as a kindergartener will lose them. Adults do not want to feel stupid, slow or incapable. For these reasons the first in-service, class or introduction should give adult students an open-ended way of handling their own learning. Information should be interspersed with hands-on activity. Terms can be given in small numbers and program directions learned as they work. As E.T. would say,"Don't anyone mention programming at this point!"

The way programmers work or how static electricity may wreck your program should remain a mystery. In teaching someone to drive, one doesn't discuss or talk about transmissions or drive shafts. In the same manner, keep people learning how great this tool is and what is can do for them. Be sure the presentor has enthusiasm and talks in simple terms, not computer lingo. Teachers may never need that course in programming so take it easy.

Once teachers begin to see the possibilities in the computer, especially for home economics, they may be given a chance to learn to use a more sophisticated program such as the wordprocessor. This takes some time, but for the person who had never been a good typist, even those who have, wordprocessing is a life saver. Imagine never having to retype a paper, notice, or anything! All the poor typing in the world can be corrected by inserting left out letters or adding them. Wrong letters, words or paragraphs can be deleted as well. Paragraphs can be moved around. All this can be done with just a few strokes on keys. Then how it is printed can be changed by a few directions to the computer. Do you want single lines, something centered, paragraphs two or three spaces, the margins changed? By saving the material on a disk, it can be repeatedly used and printed any number of ways. Most home economists do not know how this looks on a page. Typing students in high schools have been using word processors for some time. But by showing teachers how this can help them, they may become motivated to start to learn for themselves.

There are some very good programs designed for novice teachers to follow. Most are concerned with teaching for programming skills so that students learn data entry, operations, and programming. One such course from the University of British Columbia by Dr. Peter Braun would be a good course for teachers who have already done some work. Without too much difficulty a school district could get a course that would teach teachers the beginning of more advanced operations on the computer. These courses need some local talent willing to learn and willing to teach others. Perhaps some teacher with release time or some administrator or a curriculum supervisor could be found who would be willing to act in this capacity. It is also possible to write a proposal for funds under different auspices to have some in service as well as hardware money.

Whatever approach is taken, training and desire work with teachers the same as it does with any students. Given the opportunity to see the possibilities, most teachers can gain confidence and see the possibilities in computer assisted education for home economics as well as many other subjects.

SPECIAL USES FOR ALL EDUCATORS

There are some functions done by computers that would help any teacher. Any teacher and home economics teachers,in particular, collect mountains of paper in the course of a few years. Limiting the amount and organizing it for use is always a job whether working in the public schools or in a university with an office secretary. There are so many papers to type, so many records to keep that teachers eventually will want to have access to a computer for their classroom preparation. Having a computer in a teachers' work room will not be uncommon in the future. The software that permit typing and storage of papers is available today eliminating the overstuffed files that are usual for home economists. Since the files on a disk can be easily found through the filing system, the material is readily available. Some software is now able to bring to the screen files in Basic, in the wordprocessing file or the spreadsheet file. Such compatibility makes finding files much easier.

Test construction has always been a required skill for teaching, yet few teachers have the time or knowledge to keep upgrading their tests for validity and reliability. The time consuming problem of retyping and duplicating tests can now be eliminated and the refinement of tests are a possibility. By producing test items and catagorizing them according to the level of cognition, type of item, and subject matter, teachers can use different items from a bank of items and produce tests of comparable difficulty on the same material. This means that students who are absent for a test can easily be given a comparable make up test or in crowded classrooms different tests can be easily assembled for students sitting side by side. Not only can these tasks be accomplished with some ease, but test items themselves can be analyzed, particularly if the results are corrected by the Scantron system. Items that are repeatedly answered incorrectly can be corrected for clarity and the level of difficulty of items can be observed. Test making is a high level skill taking much time and effort; taking the routine, repetitive work from test making should make it possible for teachers to improve that skill.

Most of all, educators who have interest in computer assisted education enjoy the interaction with other educators with similar interests. At this point in time, those people seeking to learn and to incorporate computers are the innovators of the profession. These are the educators who have farsightedness, who like a challenge, who are optimistic about education and the future. Those who enjoy life, learning and the adventure of the unknown are great people to know and interact with. These are the people who take courses, who buy equipment, write software and attend computer shows. They are the people who have asked the questions.

EDUCATIONAL QUESTIONS

Questions about results of Computer Assisted Instruction have been reviewed in various journals. A review of CAI in 1980 showed consistently improved performance in 45% of the studies in science and foreign language, and on standardized tests with the use of CAI. It was found to be as effective as other teaching methods in the remaining percentage,55%. In the words of Dr. Miller, no one tool can be expected to be a "quick fix", nor will any one method of learning appeal to all students. Studies did show that up to 40% of the students learn faster with CAI and retain more of what they learn. Interestingly lower level students required more time for learning, but there were a greater number of these students who obtained greater gains and who managed to meet the objectives of the lessons using CAI than without it (Dence, 1980). These studies were concerned with secondary and post secondary learning and usually involved main frame programs, but the interaction of student with computer does not change with the size of the equipment so it can be assumed that lessons on microcomputers would have the same kinds of results.

Results with microcomputers as a teaching aid in elementary schools have consistently been positive. The academically deficient students have been reported most often as improving in their performance (Esbensen, Sept, 1980) Some of the studies have had the use of a minicomputer in the schools. Once again it should never be anticipated that every students will attempt nor enjoy this kind of learning, but there are many who do. One obvious factor in the learning sequence is that teachers must give some individual attention. Many slow students have not had that opportunity. Getting feedback from the machine is also a factor. Actually students like the sharing of a computer. More than one student at a computer terminal can make the learning situation a social experience. Where strict discipline and rigid times are kept for the use of the terminal or keyboard, sociability would be expected to be absent and the experience might even prove to be a negative one. As usual human learning factors are complex and differ with individuals' perceptions. At present the excitement of the computer may be producing a "halo" effect on student learning. What ever the cause, learning seems to benefit.

At best, teaching will benefit in the years ahead as this tool enters into everyday life. Students will work at home, if they can get the computer away from Mom and Dad. Portable computers will go with many to college or boarding school just as the father takes his along on his business trip. Small children may learn to read with more ease; to understand complicated rules of nature and mathematics with ease and joy. Hopefully those students born in obscure places to families with little income will not be kept from experiencing the high technology of the age in which they live. Humane societies attempt to pass along the culture to all. Computers can be a positive force in the society to divide the society into haves or have nots. Continuing support for education is needed to accomplish that goal.

Any time teachers can see positive results, that is feedback for their performance. Students who learn and are interested are one reason teachers, who value helping others, enjoy their work. Without that feedback, teachers can be discouraged and become victims of "burn out". So there may be some studies in the future of the results to be noted in teacher performance as well as student performance. Instead of school district worrying about high school students paying the games on the video machine, learning and an improved teaching environment is possible with the introduction of computers on a wide scale.

The present situation, where science, math and a few English teachers are spearheading the introduction of computers in the schools, may have some influence on the way certain subjects are viewed by students as well as parents and the public in general. Certainly Americans have always expected to have their children educated in a manner which would enhance their future employability. Knowing science, mathematics and communications has been an important skill in the workplace. With additional prestige for these subjects because of the activity of these subject teachers, one wonders where will all the rest of the subjects be? Can history, social studies, Spanish, German, French, political science, or home economics afford to fall further from grace? Public perception of these subjects may not change because they have shown only a little use of the computer as an aid. Some exceptions may help their image.One high school runs a social studies, decision making program with the aid of a computer( ).It is interesting and vital. There may be many more that have not been written about. Regardless, the public will judge whether accurately or not.

Home economics stands now at a crossroads in many schools across the nation whether secondary or post secondary. As the 1982 AHEA convention session "Where have all the Home Economics Majors gone?" asks, we need to ask also. There are fewer young people; women are seeking other roles not identified with home; the field does not provide high paying jobs? Some of the answers may be there. If so, there is little control over external social changes, but it is possible to become as vital a field as we can. Of course, there are many ways of doing that and computers are not the sole answer, but the question that remains is, "where will home economics be in the scheme of things ten years from now?"

While others move ahead, those who do not will be a noticeable few and be labeled as reactionary rather than just slow to change. The image we would like to have is not that. But the image we have ten years from now will be the one we create. Hopefully, that image will include the use of microcomputers.

ADDENDUM TO HOME IS THE COMPUTER

The Year? 1983, January. The Place? A small town in Texas. The program-for the Users group . The young man held a small walkie talkie piece of equipment in his hand. He spoke into it after dialing his home phone. The mechanical voice came back, " 1. I can forward your phone calls. 2. I can look outside of the house, 3. I can set the airconditioner. 4.I can tell you the time.5. I can turn on the lights. 6. I can listen for your children. Push the number you want." Tim chose number four. The prompt reply came. Tim explained that the use of a small computer, dedicated to just the operations the homeowner wants done is not a thing of the future. He has it operating. He can receive telephone calls, check on his home for any sign of fire or he can listen outside of his home for intruders. If he want to turn lights off or on, set his furnace or airconditioner, he can do it and be 60 miles away. Such a system requires a small computer always operating and connected to electrical equipment in the home, some of which may be run on small batteries, like the smoke detector or the sensors on the doors and windows that can tell when a warm body moves to illegally enter and then calls the firemen or police. In fact the computer will report the disturbance and ask if the message is clear and repeat it if necessary. For the person living in the city or country, security at home may be possible. Tim went on with his explanation. He expects to put a small TV receiver in his pick up truck so that he will be able to receive pictures as well as messages. Then he'll not only know someone is outside of his house, but he will be able to see them! The age of fantasies has come true.

Tim Skaja of Greenville, TX, speaker at the TRS-80 Users Group, Jan. 20, 1983

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Prog Name	Computer Brand	Grade Level	Curriculum Area	Manage t Syst Provided?	Program Type	Price	Reviewer's Comments
Meet the Presidents	Apple 48K	N/A	History	yes	Drill and Practice	$39.95	-Good use of graphics and sound -Clues can be changed to fit different curriculums
French	PET 8K	N/A	Language	yes	Drill and Practice	$15.95	-Student can control pace -Different modes of learning available
Lemonade Stand	Apple II 48K	3,4	Business	yes	Game	$25.00	-Learn about market size -Illustrates the realtionships between supply and demand well
Word Relationships	Apple III 48K	10-12	Vocabulary	yes	Drill and Practice	$79.95	-Useful tool for learning analogies -Good preparation for the SAT
The Vocabulary Baseball Game	Apple II 48K	N/A	Vocabulary	yes	Drill and Practice	$24.95	-Student has control over length of the learning session -Large base of words (1000) -Game format and competition helps hold interest
Market	Apple or TRS-80	N/A	Business	yes	Game	$25.00	-Good simulation of a competitive market -Develops skills to deal with - profit, market share, inventory and total assets -The random variables that enter in add realism
Arith-Magic	Apple 48K or TRS-80	3,4	Math	yes	Drill and practice	$35.00	-Long title page is boring because it is repeated each time the program is is run -The fixed speed can allow the user to fall behind

Figure B-1 CAI Software Packages

From a study of Computer Use in the Schools
Carnegie-Mellon University

Computers and Home Economics

Beatrice Petrich

"The computer is a source of knowledge and a partner in exploration." "Garbage in, garbage out." "Ignoring the home computer is like ignoring the weather." "Initially intimidating, now affordable, it soon becomes indispensible." These ideas are becoming platitudes, yet many of us are still confused and a little frightened about the use of computers in home economics classrooms. Hopefully we know the computer cannot replace the teacher. Could it be a cure for "burnout"? The purpose of this chapter is not to teach you about the computer or the jargon, but rather to explore potential uses of the computer in the home economics classroom and to point out why the home economics department may be the most important department in the overall approach to the use of the computer in today's society.

There are three major areas in which the home economics department should be involved with the computer. First, the home economics department must utilize the computer for instruction; modes of instruction made possible by the computer should be as readily available in home economics as in any other department in the school. This is commonly called Computer Assisted Instruction (C.A.I.) or Computer Based Instruction (C.B.I.). The second area of involvement, also used by other departments is classroom management. The home economics teacher, however, may reap more benefits from a computer managed department than departments with less equipment and space to manage. The very nature of the laboratories and supplies utilized in home economics makes management a number one priority. Third, the home economics department has a unique responsibility to help students learn to be effective consumers and users of equipment for the home. Just as home economics teachers needed to update themselves when the microwave oven became a rather common home technology, they need to update themselves to effectively teach about the home computer. It is only in home economics classes where students will be able to explore questions such as: Should we buy a computer for our home? Is it too expensive for our lifestyle? Will it harm family communication? How should it be used in the kitchen, the family room, the home office, for family education? What kind can we afford? The computer is rapidly becoming a consumer problem which involves money management, family decision making, family education and recreation, and family values. Home economics teachers have an academic background which prepares them to help young people with the complex problems which the computer poses for satisfying family life.

These three areas of concern will provide the focus for this chapter: 1) Instruction, 2) Management, and 3) Consumer Product Education. According to the Association for Computing Machinery, teachers should be able to read and write a simple program, have experience using education software and documentation, have a working knowledge of computer terminology, and be able to discuss the moral or human impact issues (Taylor, 1980). This chapter will be concerned with education software and documentation and the moral and human issues which relate to the home economics teacher.

Computer Assisted Instruction

Bobby Goodson, president of Computer-Using Educators, the largest educational-computing users group in the country, says:

> No matter how we look at it, there's going to be a restructuring of the way we look at education. The computer does some things marvelously well, probably better than the best teacher can do, like rote-memory drilling and certain kinds of learning that go on with repeated work. But a teacher can do many things that no computer can do (Wrege and Watt, 1982, p. 138-39).

He goes on to emphasize that we need more personal interaction, more encouragement, and that we can free the teacher to do that if the computer can do other things. Of course, the key to this is appropriate courseware or software.

Six modes of instruction are most commonly used for computer assisted instruction: inquiry, tutorial, drill and practice, gaming, problem solving, and simulation. These are modes which have been utilized in home economics instruction in the past and will continue to be used with the help of the computer or without. If the computer can be more efficient and productive utilizing a particular mode, this will free the teacher for the creative, decision-making, and planning tasks of teaching to maximize the human aspects of the art of teaching. Applications in home economics will be discussed in the traditional conceptual areas.

Applications in Family Living

Braun and Slobodzian (1982) list some charactertistics of the computer which make it especially suitable for computer assisted instruction in family life: the computer is patient, the behavior of a computer is predictable; it is oblivious to personal appearance and the background of the user; it cannot detect a user's sex, race, or even personal hygiene, it cannot be shocked, angered, or embarrassed. When helping students to examine their own values and feelings about family life and its' many controversial issues, it is not possible for home economics teachers to mask all of their own values and feelings. An unintentional negative reaction to a student's expressed belief may block both cognitive and affective development in the family life area. The computer can help modify these reactions.

Another value of the computer in family life education, is its' insurance of privacy. Although we recognize the value of verbalizing feelings and expressing problem areas, some students may feel that self-disclosure is threatening and a student's limit of psychological safety (Lockwood, 1977) may be violated.

A capacity of the computer which should be very effective in family life education is branching, the process wherein one decision leads to a cluster of options. Differing decisions lead to different options. For example, case studies describing a variety of family communication problems could be displayed on the computer and students could select from a variety of solutions which would lead to a display of a cluster of results. Students could either accept or reject the results; acceptance would lead to another case study and rejection would allow another selection with its' own cluster of results. A program of this sort could be used individually, or in small groups. Three or four students could cluster around a computer and discuss the options and the results.

Since the computer can store and display students' responses without revealing identities, another use of case studies becomes possible. As the case study is displayed, students are asked to key their responses to appropriate questions. The computer can be programmed to store the responses and to recall them with the appropriate signal. At a later time, perhaps after a reading assignment, students may recall their classmates' unidentified responses and evaluate their own responses in light of their peers.

More simple applications of the computer in family life education can utilize easily programmed techniques such as Likert scales and true-false exercises. Teachers may quickly score attitude scales for individual students, classes, and several classes. Such scores enable students to compare their own beliefs and attitudes to those of classmates. More complex comparisons could be made based on mean scores by sex, between parents and students, and between grades or classes. Such comparison is an excellent technique for value clarification. If the computer has graphic capacities, the results of questionnaires and inventories may be displayed in various manners which are appealing and may have a greater impact on the minds of the users.

One may ask, where do we find these programs (software)? A constant and on-going search of catalogs, journals, and stores has proven fruitless to me. Hopefully, as educators become more involved in programming, these lacks will be remedied. Until such time as these types of programs become available, it is recommended that classroom teachers develop enough skills to communicate with programmers. Your own students may be able to program your ideas. Some of you may become involved in programming. Certainly, you have a wealth of ideas for presenting subject matter in family living and have the training and background for presenting the material in a logical and rational manner. Those skills which aid you in curriculum and lesson planning will aid you in communicating your ideas to a programmer (or a computer). Braun and Slobodzian encourage teachers; "The gap between theory and practice is in part a gap between technology and application." (1982, p. 510). Creating software or contributing to its' development may be a new teacher responsibility necessary for closing the gap between theory and practice.

Applications in Child Development/Parenting

It goes without saying that techniques and practices which apply to one area of home economics may be used in other areas. This is especially true for family life and child development, or parenting. One of the common concerns about the use of the computer in people oriented curriculum areas is that students will not be developing human relationships skills. Robert Isenberg, a middle school teacher in Madison, Wisconsin, states, "The key to establishing these cooperative groups during computer activities is structuring social interaction at the terminal so that students are aware of their dependence upon other group members in accomplishing their goal." (Isenberg, 1981). He illustrates one of his methods for teaching social skills through cooperative groups when he explains how he uses a simulation program. Students are assigned randomly to groups, and group members are assigned duties such as reader or keyboard operator. Guidelines for behavior are established. Guidelines include rules such as: no input allowed into the computer unless all group members agree; ask each other's opinions; question for clarification; and check for consensus. It is easy to see how this sort of activity can be assimilated into the child development/parenting curriculum. Decision making and conflict resolution situations are an essential part of parenting and relate closely to other goals in the home economics curriculum.

In addition, this area has some basic knowledge which is required before the higher levels of learning can occur. For this basic knowledge, the computer can be used for review, for enrichment, for make-up work, and for testing. As in the family living curriculum, value clarification and self understanding are important affective goals, and those ideas mentioned for family living may be easily modified for the child development/ parenting curriculum.

Applications in Consumer Education

This is the area for which many "canned" programs are available. The most commonly used "sales pitch" for the purchase of home computers is "It will help you manage your money". There are many cash management or budget oriented programs on the market and selecting the one which is most suitable for a family or individual is indeed a consumer problem. Thus, just as home economics classrooms have attempted to provide experiences for choicemaking in the past, it is appropriate for the family oriented consumer education aspect of home economics to provide examples of "software" for students to use. However, record keeping is merely a basic skill for effective consumption and the computer can be an effective aid for the decision-making, value analysis goals and experiences which are part of consumer education in home economics. There are several financial management programs being utilized by cooperative extension programs across the country, so the county home economists might be a source for classroom ideas.

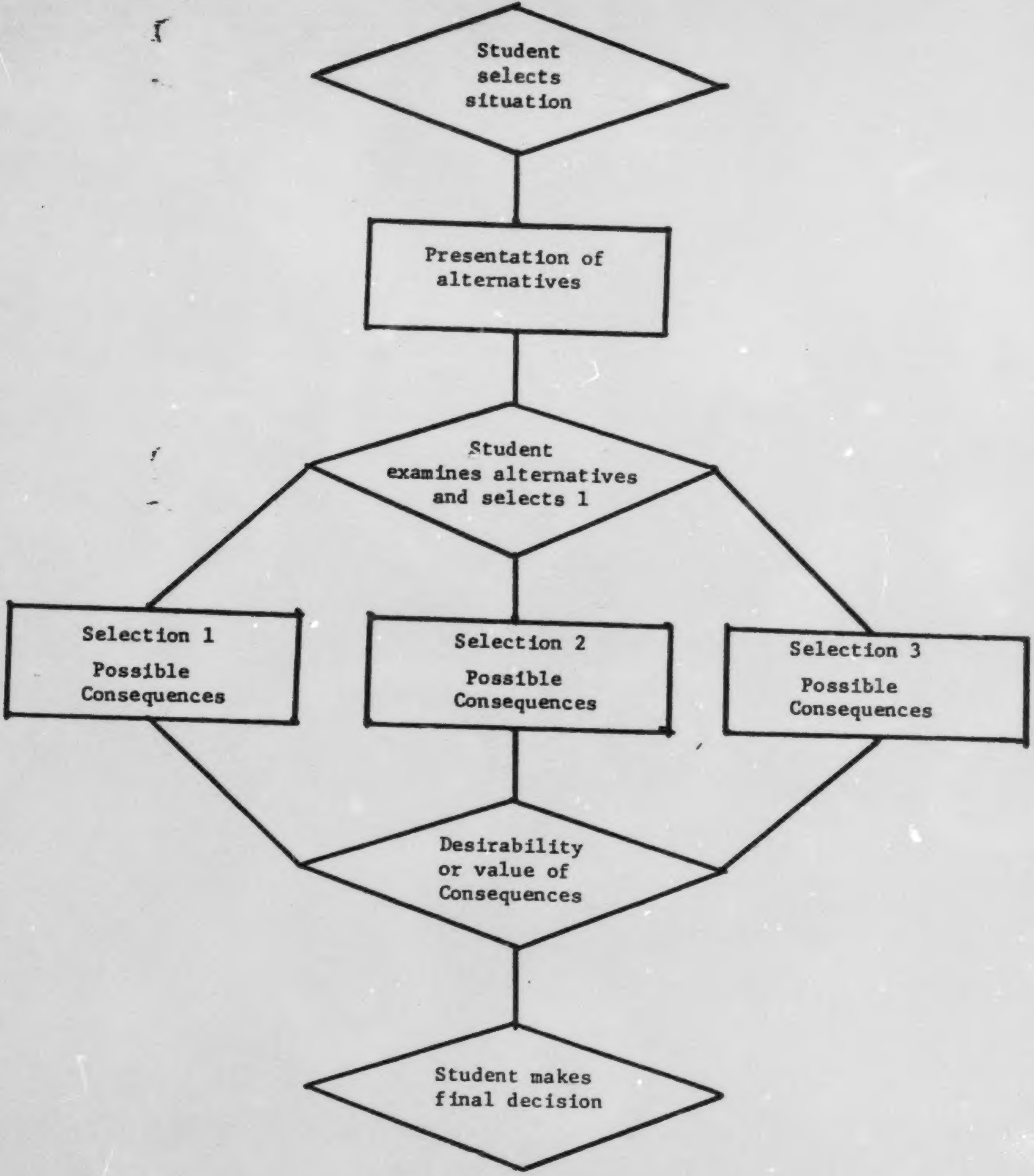
Perhaps this is an appropriate place to present a basic type of flowchart which teachers may prepare for programmers. The simple diagram shown in Figure I illustrates a basic model in which consumer decision-making situations may be presented and students may proceed through alternatives and consequences to a decision. In the diagram, the diamonds represent parts of the program where choices are made by the student and the rectangles represent information presented by the computer. A program based on this model could be used in the classroom as individual or group learning, and the situations could be adopted to any area of home economics.

Applications in Housing

Many of the available programs in the housing area are based on numerical aspects of housing such as home heating/air conditioning costs, household energy use/cost alternatives, window heat loss and covering costs, costs of building a home, and buying versus renting costs. The esthetic and human relationship goals which are included in family focused home economics programs are extremely difficult to program. Hopefully,

FIGURE I

Consumer Decision-Making Flowchart Model


Student selects situation
Presentation of alternatives
Student examines alternatives and selects 1
Selection 1 Possible Consequences
Selection 2 Possible Consequences
Selection 3 Possible Consequences
Desirability or value of Consequences
Student makes final decision

these programs will be developed, but at present it would appear that teacher time and energy consumption would not provide enough return for the busy classroom teacher to develop her own programs. However, wise utilization of available software will free time for both students and teachers to consider such important issues as esthetics, societal problems, human relationships, individual self-actualization, and family life style when studying housing.

Applications in Foods and Nutrition

Dietary analysis software is almost as plentiful as financial planning software. Brown, Hoover, and Cross (1982) categorize the dietary analysis systems as 1) nutrient data base tapes and disks on large computers, 2) dietary analysis disks on small computers, and 3) optical readers of food frequency forms. The forms used for optically scanned dietary analysis are easier and faster to complete and analyze than are 24-hour food recalls or records and small hand-held pre-programmed computers are available to the general public. The natural motivation connected with using a computer, plus the speed of feedback information, make these programs especially appropriate for middle school youngsters. The range in quality of dietary analysis disks for small computers is enormous. Some available from county extension programs deal with food spending plans, food analysis for nutritional adequacy, or food consumption related to weight and energy. Of course many of the more popular nutrition related programs are focused on weight loss.

Programs for food preparation and family meal planning are just beginning to gain in popularity. The teacher may want to develop simple programs which relate to the texts she is using so the objectives are carefully tailored to student needs. Students may be taught to use the computer as a recipe bank and as a means for controlling food expenditures. Rote learning exercises such as those related to measurement equivalents, storage techniques, and sources of food nutrients, can easily be entered into a ready made program. If you are a recipe collector, the option of calling up a recipe on the computer rather than thumbing through baskets of clippings or smudged cookbooks is indeed inviting. Programs are also available for customizing recipes for varying numbers of portions. Perhaps one of you can develop a program for customizing recipes for specific dietary needs. A running shopping list is a rather obvious use for the computer; helpful for the home cook but a lifesaver for the home economics teacher who may be purchasing groceries for 20 or 25 family sized kitchens in one order. Students can easily be involved in preparing shopping lists when the computer is utilized.

Textiles and Clothing

While Alvin Toffler is predicting that we will be feeding our body measurements into custom design houses for our clothing, the available software in this area is much more mundane. There are several programs related to stain removal and budgeting for specific family clothing needs such as for children, but this seems to be a family and human relationship area which has been neglected by computer program procedures. It would seem conceivable that yardages, metric-English equivalents, pattern sizes and body measurements, and comparative costing of fabrics would be reasonably easy to program. It will take a great deal more creativity to develop programs which deal with such important aspects of clothing as self-concept, development, inter-cultural relationships, and stereotyping.

Buying Software

After reading about the available programs, you may be left with a feeling of frustration. It is frustrating to me to be sharing these ideas with you and not be able to give you addresses, titles, and prices but space and "politics" just do not allow it. There are several sources for software and your school supply catalogs will have some lists. Most hardware providers have software catalogs and some school journals and magazines are beginning to carry advertisements for software. I subscribe to several popular computer magazines and computer journals and attempt to scan them each month for home economics related material. Attendance at professional meetings has provided additional opportunities for awareness of software programs. There are several good evaluation devices for software and I will be glad to send one we have developed if you will send a self-addressed stamped envelope with your request.

To summarize the section on Computer Assisted Instruction (CAI), there are several guidelines for purchasing software which you may find helpful. Barden (1983) suggests: 1) buy as few software packages as possible, 2) do not count on software "promises" when you purchase hardware, 3) carefully evaluate free software, 4) be sure it is documented and use the documentation as a buying guide, 5) buy programs in assembly language rather than in higher level languages such as BASIC, 6) see the software in action if possible, 7) be sure back-up discs are available, and 8) buy from responsible dealers.

Using the Computer for Department Management

If we can feel more comfortable knowing that computers need not require a drastic change in teaching style, we may welcome with open arms a drastic change in department management. Zuboff (1982) predicts that with the new information technology, managers (teachers) will do a variety of tasks that others once did for them. Perhaps the computer will do away with the teacher-aid (that few of us had) but it will never replace the teacher.

At the risk of being repetitive, home economics is unique in its potential adaptability to computer use. Just a few of the management tasks which can be simplified by computer utilization are inventory of equipment; running budget records for food, equipment, and supplies; advisory committee address lists (mailing labels) and individualized communication records; pupils records of projects and grades; grading; data for state and federal reports; and dealer and service addresses and phone numbers. If you are involved in any kind of competence based projects, on-going record keeping and feedback becomes possible, thus enhancing the individualization of instruction. Cooperative programs lend themselves especially well to computer management. Student and employer evaluations can be rapidly checked before making a visitation to the work site and will be easy to summarize at the end of each evaluation period. Communication records for employees, students, and advisory committees can be kept accurately and completely.

If you are beginning to think that learning all of these things and preparing programs which may not be available will be more "hassle" than continuing on the comfortable "burn-out" path of tradition, you have a legitimate concern. Not all of these things can be accomplished immediately and each school system, community, and individual will need to set a pace which will allow for utilization of technology for management while maintaining their own human and educational goals.

Home Computers - A Consumer Problem

The home computer is everywhere! A very short time ago, it was available only in specialty stores frequented by "buffs." Today it is in discount stores, department stores, mail order houses and toy stores. Undoubtedly, it will soon become a commonplace home appliance. How can we teach people to be intelligent purchasers and users of computers? The implications for family life styles and values are mind-boggling and the subtle nuances of the computer's effect on family life cannot be ignored when teaching about the computer as a home appliance.

The obvious consumer skills must certainly be included when planning curriculum and lessons: comparative shopping, advantages and disadvantages, relationship to total family expenditures, family values, long-term planning, and use. Just as we made a variety of kitchen equipment available so students could judge merits by actually using them, computers of a variety of styles and price ranges should be available somewhere in the student experience. A field trip to the power company was once the only way to see a microwave oven in operation. This may be an inexpensive way to help students view a variety of computers.

Less obvious concepts must also be included in consumer education for purchasing computers in a family oriented home economics program. There are those who believe that computers will increase the distance between the "haves" and "have nots" in our society because the computer will be available in the more affluent homes for educational uses. This is an issue certainly worth discussing with your students, but an even more important issue has to deal with whether people view education as a legitimate function of the family. The computer may well provide a jumping off place for some stimulating discussion about the computer in the family in relationship to family values. Issues such as privacy and life space are also related to home technology of all kinds. It is doubtful that these issues will be raised in economics or business education classes. Perhaps family functions, structures, and roles are far more important issues for computer consumer education than are dollar cost and other economic factors.

A short list of computer uses which reflect family values is shown in Figure 2. A discussion of the pros and cons or a rating of importance in small groups or individually could serve as a valuable exercise in value clarification.

FIGURE 2

IS THIS AN IMPORTANT USE OF THE HOME COMPUTER?

Teach young children addition and subtraction

Keep a running tally of tax records

Monitor household expenditures to guard against overspending

Track personal investments such as stocks, bonds, and mutual funds

Store your favorite recipes and adjust ingredients to feed various numbers of people

Inventory household possessions for insurance purposes

Manage the teenager's paper route

Maintain Christmas lists and addresses

Write school assignments (term papers)

"Chat" electronically with other home computer operators

Play Pac Man

Make discussions about family budget "actually pleasant"

Learn to type

Learn a language

Write personal letters

Keep a personal diary

Learn to repair the car engine

Dial-up libraries

"Shop by computer"

Develop programs just for our family (for example: plan a vacation or play a game)

DISCUSSION QUESTIONS

1. Select five most important uses, 5 least important uses, and compare with other class members' lists.
2. What members of the family will perform the uses listed?
3. Are there any uses which might allow someone to invade your privacy? How?
4. What are other uses not listed here.
5. Are there uses which might be harmful to a family? Why?

Summary

The question still is there. Should I or should I not invest the time, energy, and money to become computer literate and to learn to be a competent user of this new teaching tool? No one can answer for you. However, a consideration of almost twenty years of computer assisted instruction resulted in some conclusions which might help you decide. Kearsley, Hunter, and Seidel (1983) identified nine major outcomes from over 50 major projects. The outcomes help each of us to examine our place in the progression and it is comforting to know that not everything has been done and not everything which has been done is perfect. The outcomes were:

(1) There is ample evidence that computers can make instruction more effective
(2) We know relatively little about how to individualize instruction
(3) We do not have a good understanding of the effects of instructional variables such as graphics, speech, motion, or humor
(4) A great deal has been learned about overcoming institutional and organizational inertia and resistance to change in the context of implementing CBI
(5) Significant progress has been made on the development of authoring tools and techniques for CBI
(6) Good mechanisms have been developed for the dissemination of CBI ideas and courseware
(7) CBI has spurred research throughout the entire field of instruction
(8) Federal funding has played a pivotal role in advancing CBI
(9) We have just scratched the surface of what can be accomplished with computers in education (Kearsley, Hunter, and Seidel, 1983, p. 90)

They concluded that research related to Computer Assisted Instruction has had a substantial impact, but that a much greater impact is anticipated for the future.

During an interview for Popular Computing, Alvin Toffler predicted that one-fifth of the American labor force will be working from home instead of commuting to a central location within the next 10 to 20 years (Wollman, 1982). The home of the future will be an "electronic cottage" according to

Toffler (1980). He also envisions that education will quite naturally shift from the schoolroom to the home and the computer and television will be linked up for interactive or two-way systems. Although Toffler is not interested in a personal robot for domestic chores, Wollman (1982) wonders if his wife will be interested.

Considering the views of the recent past and the far future, Margaret Arcus' statement in a recent issue of the Journal of Home Economics seems like an appropriate closing thought. "As it is likely that technology will play an increasingly important role in our lives, we need to think clearly about the ethical implications of technology and to help ensure that the outcomes of technology will improve and sustain the quality of life for all." (Arcus, 1982, p. 38.)

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Don Slack

MICROCOMPUTERS
IN THE
ELECTRONICS
CLASSROOM

THE NEED

Microcomputers are used in almost every facet of industry and education. A most important question that has often been ignored but now needs to be asked by educators is: "who repairs the microcomputer when it breaks down?" The electronics student should be learning how the microprocessor and microcomputer work, how to interface the computer to the outside world, how to troubleshoot, and how to repair microcomputers and related equipment.

The rapid growth of the microcomputer industry, with expanding use of the microcomputer in business, education, homes, and as industrial controllers is creating thousands of new jobs for the trained electronics technician. The technician who services the microcomputer has a unique requirement - - he must have some expertise in programming as well as a good understanding of the electronics theory.

THE PROBLEM

Many vocational electronics teachers are already exposing their students to microcomputer fundamentals. Unfortunately, too many (especially high school) students are not learning microprocessors as part of their initial electronics training. Probably the money crunch keeps many instructors from buying microprocessor training hardware. Too often, however, the problem is that the teacher knows very little about them!

If a low budget is the reason for not offering microprocessor training, careful planning and selection of appropriate hardware, software, and courseware is necessary. Good training materials don't have to be expensive, but neither are they cheap. Several low cost personal computers available on today's market have no classroom theory or lab manual support. They are not easily interfaced for experiments. They are machine language programmable only by Peek and Poke statements from BASIC and because they break easily are not a frugal investment.

The novice instructor is in the same boat as his students. Machine language is a mystery, microprocessor family selection confusing, and Latin is easier to understand than BASIC. Where and how does he learn enough to stay ahead of that "fast burner" from Central High? The more experienced instructor may need help in deciding what new equipment to add to the electronics lab. In this paper we hope to give both groups of instructors some information and ideas to help them make some intelligent choices. The author certainly doesn't have all the answers, but will try to present some ideas and thoughts.

In choosing training equipment cost, microprocessor type or "family", language, software, instructional materials, and hardware are factors to be considered.

GENEOLOGY

The microprocessors used in most 8-bit computers fall into three groups; the 6502 family, the 6800 family, and the Z-80/8080 family. A decision must be made as to which family the course is based upon since there is usually not enough time available for the student to thouroughly learn more than one CPU chip. A brief survey of local business and industry may be in order to determine which microprocessor is predominatly in use. This survey may show that an industrial controller microprocessor--such as the 1802 or 2650--is more widely used locally than the better known families. Availability of hardware, features, and prepared course materials will certainly influence the instructors decision.

Generally, the 6502 family is found in several home or personal computers including the Apple, Pet and Vic (by Commodore), Atari and a few small business computers. The 6800 family is found primarily in automotive and industrial controller applications, and a few small business computers as well as the Radio Shack Color Computer. The Z-80 family includes the Z-80, 8080, and 8085 microprocessors, and are found in the familiar Radio Shack TRS-80 Models I and III personal computers, the Model II business computer, the Heath/Zenith H-8, H-89, and Z-100, the Timex/Sinclair, and at least 60 small business computers. The Z-80 family is also widely used in industrial controller applications as are all the other familiar microprocessor chips. It should be noted that when microcomputers are mentioned most people think of Apple or TRS-80. In fact more microprocessors are used in industrial applications than there are personal computers in existence.

LINGUISTICS

To communicate with the microprocessor the student must learn to speak a "foreign" language, a language which the microprocessor understands. Computer languages are considered to be either low-level or high-level. The lowest level language--binary number code--is the language that the microprocessor actually understands. An 8-bit microprocessor must receive instructions and data in the form of 8-bit words for internal use. It is difficult for the human operator to "think binary." Different number schemes have been devised to make data entry easier. Octal and hexadecimal number systems are two of these schemes, with hexadecimal the most common method. These number schemes are called Machine language. The advantage, or rather the necessity, of using Machine language is that the student is forced to work down at the chip level of the computer and therefore gains a real insight as to what actually happens inside the microprocessor.

Another low-level language, a step up from machine language, is Assembly language. Assembly language uses three and four letter mnemonics for instructions to the microprocessor. A program, the Assembler, converts the mnemonics to the proper numbers or opcodes for use by the microprocessor. This relieves the student from some of the drudgery of looking up each opcode while writing a program, while still retaining an intimate knowledge of the microprocessor structure. Assembly language is more expensive than Machine language because of the additional memory, assembler program, and the terminal required for operation. Note that Assembly language is really taught for program writing, with the student doing the "pencil and paper" assembly for actual Machine language entry in hexadecimal form in most single-board trainers.

A major disadvantage of low-level languages, especially for a first exposure to programming, is that students may lose interest because the language is difficult to grasp and they are not seeing any familiar action on a TV screen. Interest may be retained by including some simple interfacing projects early in the course.

High-level languages like BASIC, PILOT, or Pascal, on the otherhand, allow immediate interaction between the student and the computer.

The CRT or the printing terminal allows the student to see the result of his/her efforts on a display as familiar as a home or arcade video game. Interest is high, and the language is in more familiar English terms rather than numbers; but the interest must be channeled into a desire to learn how and why the computer works. The high-level language shields the programmer from the inner workings of the microprocessor, but of course that is the reason for having a high-level language. TRS-80 Interfacing, Books 1 & 2 and Apple Interfacing, both by the Blacksburg Group teach interfacing electronics while programming in BASIC. The books are published by Howard W. Sams & Co, Inc. and they should be considered for use in the electronics lab if the TRS-80 or Apple is already in use.

High-level languages are most suited for developing Computer Aided Instruction (CAI) materials for teaching such subjects as color-code, Ohm's Law, theory, or for progress testing. Game formats are popular in presenting CAI materials. There is a fine line between game formats for teaching information or principles, and just playing games. Be selective in buying or developing CAI games.

BOX or BOARD

A variety of hardware is available for learning microprocessor fundamentals. Hardware can be divided into two broad categories--the single-board trainer or evaluation board, and the "stand-alone" computer.

Most of the microprocessor trainers for the electronics shop are of the single-board type. Some are made by the microprocessor manufacturer for engineering evaluation boards or controllers. With some modification and addition of minor components they make excellent trainers. The Intell SDK-85, the Signetics Instructor 50, the Rockwell AIM-65, and the Synertec SYM-1 are good examples. Training materials that come with these boards are not especially suited for beginers. Several good books are available from other sources, however, that offer training programs based on all of these boards except the Instructor 50.

Single-board trainers offered with integrated course materials especially for beginning classroom use are available. The Heath/Zenith ET-3400 and the E&L Instruments Fox are only two examples. Course materials and hardware are excellent for both of these trainers. Ease of interfacing and expansion capability as well as board specific programming and interfacing projects at reasonable cost make both units excellent buys for beginning as well as advanced students.

All of the single-board trainers are low in cost and, with one exception, use a hexadecimal keyboard for data entry and 7-segment LED read-out in machine language. They allow the student to get into the microprocessor architecture "up to their elbows." Simple access to data, address, and control lines allow a variety of interfacing projects using either wire-wrap or solder-less socket breadboarding methods. Some have cassette recorder interface and read/write routines built in: a handy feature for saving that long program for next class period. Some single-boards allow expansion of memory, addition of high-level languages, or even disk drives. Every microprocessor family is available, most in a variety of configurations.

Thousands of "stand-alone" or personal computers are already in use by both academic and vocational instructors for teaching programming and for CAI. Apple, TRS-80, and Pet computers are predominant, but with prices tumbling and with price-wars, especially on the low-end models, thousands more are finding their way into the classroom. If this type of computer is available, then by all means use it! If a personal computer is being considered for addition to the electronics classroom and shop then take time to analyze both strong and weak features for electronics students.

Probably the strongest good features of the personal computer are a high level language, peripheral add-ons, and a video display. Good CAI programs can be purchased or written expressly for the needs of the electronics student. As discussed earlier, however, the student is shielded from close interaction with the microprocessor unless an Assembler is purchased for the machine. Printers, cassette recorders, or disk drives can be added to the machine at reasonable cost to make a powerful, full-blown computer.

The weakest features are difficult microprocessor access (without an Assembler), difficulty in breaking out important lines for interfacing, and access for troubleshooting practice. The Apple does use plug-in cards on a mother-board and the TRS-80 has an expansion connector. Text-lab books covering interfacing for the Apple and TRS-80 are available in the Blacksburg Continuing Education Series published by Howard W. Sams & Co.

Most of the other personal computers have access only through I/O ports. Adapter breadboards may be designed and constructed, but may cost as much as a single-board trainer.

The thought of some students opening the box and probing inside the computer for troubleshooting practice may well send the Instructor into a state of shock! The newer low cost models with high density boards, boards covered by disk drives or CRT's are no place for the beginner to probe. If the personal computer is to be used for troubleshooting training, look inside the box for room to probe around. Some models, the Zenith Z-100, for example, may have the board pulled outside the box via homemade extension cables and plugs.

Another class of computer that should be mentioned here is the micro-mainframe. Although they cost more than the personal computer, mainframes like the North Star with the S-100 bus, and the Southwest Technical Products with the SS-50 bus have wide open access for interfacing and troubleshooting. Board extenders, Kluge (breadboard) cards, and interface cards are readily available. These computers may be expanded to multiple user multiple terminal versions to give students practice in configuring small business system, or to have several students programming on one computer. One, built by Ithaca Intersystems, even has a front panel so that the student can start out with binary toggle switch entry and LED readout, then finish the course by configuring a multi-user business system with floppy and hard disk--all on the same computer.

Initial expense is the main disadvantage of the micro-mainframe, but the flexibility and versatility deserves consideration, especially for the experienced instructor.

PERSONAL EXPERIENCE

A discussion of hardware and course materials used by the author in the classroom is now in order. Comment will include perceptions, opinions, and prejudices of this writer accumulated while teaching high school vocational, post-secondary, and adult classes at Willard J. Graff Area Vocational-Technical Center, Springfield, Missouri.

The Heath/Zenith ET-3400 single-board trainer has been the primary training vehicle for over four years. The ET-3400 uses the 6800 CPU and has an experiment breadboard built in. The parts for all experiments are standard off the shelf components and are available from Heath in low cost packages. The trainer is available factory wired or in kit form. The training text and experiment workbook is excellent. If there is a weak point in the course it is that "bells-and-whistles" (interfacing projects) come late in the course and high school students tend to lose interest before the interfacing section. This problem can be alleviated to some extent by writing some simple experiments to blink the on board LED's, sounding a small speaker, or prewiring a more difficult project for occasional use by the student. Several post-secondary and adult classes have used this trainer with excellent results. It has been observed that students that know BASIC tend to look for Machine language routines that parallel familiar BASIC routines, resulting in a higher interest level. No cassette interface is provided so long programs can be a chore to reload after the trainer is turned off.

An advanced interfacing course, and a course with an adapter module to upgrade the ET-3400 to a 6809 trainer are now available. An add-on box is available that includes up to 4-K of memory, a serial terminal port, Tiny BASIC language and cassette interface. This greatly expands the ET-3400 but when a terminal is added makes an expensive, but limited, computer system. The ET-3400 is a good basic and intermediate training system when combined with the Heath/Zenith course materials.

A Rockwell AIM-65 single-board computer is in use in our shop. This board is unique in that it has a typewriter keyboard and an on-board printer. Programming is done in Assembly language with the keyboard and mini-assembler that is part of the AIM operating system. Display of opcodes and data is on a 20-character alphanumeric LED display. Dual cassette interfaces are provided for saving programs. Plenty of add-on boards and accessories are available to expand the AIM with more memory, video, and even disk drives. Programming & Interfacing the 6502, With Experiments , by Marvin De Jong, one of the Blacksburg Continuing Education Series, is used as text and lab manual. The AIM is used for advanced students or those interested specifically in the 6502. The combination of AIM-65 and De Jong's text make a very good trainer. If you have no microcomputer equipment in your lab, you might consider the AIM-65, as it has almost everything one would want in a training system.

GENERIC

Two "roll-your-own" possibilities are being experimented with at this time to add Z-80 family training to our evening training program. One is the 8085 based Explorer/85 by Netronics Research & Development, Ltd. The Explorer/85 may be purchased as a kit or wired. The basic board has either a hexadecimal monitor ROM or ASCII ROM available. The hexadecimal version may be used with beginning students; then switch ROM's and connect a CRT terminal for Assembly or BASIC programming as the student progresses. Cassette or ROM versions of BASIC are offered as well as a disk version. Interfacing is through serial and parallel I/O ports and room is provided on the printed circuit board for some wire-wrap construction. Two S-100 slots are provided for expansion of memory or for floppy disk controller boards. With this board the student can start with a hexadecimal keypad/display and 256 bytes of memory and gradually add memory, languages, and mass storage. From simple trainer to full-blown small business system on one computer! If someone were to write a lab experiment book based on this board, he should have a winner!

Another experimental training system is based on S-100 boards and a front panel. A trainer can be assembled by mounting a mother board on a chassis containing the power supplies and installing CPU, memory, and I/O boards as needed. A terminal is required for programming and display. Languages can start at simple monitor commands and expand to several high-level choices. Boards from California Computer Systems, CompuPro, or

Wameco can be mixed with student-built Kluge cards to build up almost anything from an interfacing trainer to a multi-user small business system. A front panel for binary data entry and read out is available from Wameco. The possibilities of this combination are exciting! Most 8-bit and several 16-bit microprocessors are now built on S-100 CPU boards making a very flexible vehicle. Again, a good, experienced instructor should consider writing a lab manual using S-100 hardware.

The author is developing CAI materials for the Atari 800 to let the computer teach microcomputer electronics fundamentals. The Atari color graphics are fantastic! The student will have an inside "view" of the microprocessor as he learns how it works. Some interfacing projects will be included. The possibilities for increasing student interest and allowing him to learn at his own pace are exciting. The advantages of a personal computer with color and sound should supplement, or replace, much cf the instruction normally done with a singl-board computer in the classroom. The CAI instruction would be ideal for an individual who owns an Atari and wants to know how it works. Diskettes should be available in the fall.

YOUR TURN

If you are a beginner at teaching microprocessors, start planning a program. Do this by going to computer stores, computer club meetings, and vocational conferences. Contact suppliers of training equipment, and ask questions. Experienced teachers should be sharing their knowledge and experiences with each other by reading (and writing) magazine articles, workshops, personal dialogue, etc. Only by being informed ourselves can we excite and motivate our students with computer electronics.

Microprocessor electronics is now a part of "basic" electronics. Only by having a good understanding of microprocessor electronics can a student successfully seek a job in any field of electronics. It's up to us to give them every opportunity to learn!

Heath Company
Benton Harbor,MI 49022
ET-3400, 6800

E & L Instruments
61 First Street
Derby,CT 06418
The Fox, Z-80 MMD-1/A, 8080

Netronics R & D, Ltd.
333 Litchfield Road
New Millford, CT 06776
Explorer/85, 8085

Multitech Electronics,Inc.
195 West El Camino Real
Sunnyvale, CA 94086
Micro-Professor, Z-80

SD Systems, Inc.
10111 Miller Road
Dallas, Texas 75238
Single-board, Z-80

Quay Corp.
527 Industrial Way
Eatontown,NJ 07724
Single-board, Z-80

Motorola, Inc.
5005 E. McDowell Rd
Phoenix, AZ 85008
Single-board, 6809

Miller Technology
647 N. Santa Cruz
Los Gatos, CA 95030
Single-board, Z-80

Quest Electronics
P.O. Box 4430X
Santa Clara, CA 95054
Super Elf, Venture, 1802

John Bell Engineering
1014 Center St.
San Carlos, CA 94070
Boards, 6502, Z-80

Rockwell International Corp.
Electronic Devices Division
3310 Miracoma
Anaheim,CA 92803
AIM-65, 6502

Intel Corp.
2402 W. Beardsley Rd.
Phoenix, AZ 85027
SDK-85, 8085

Star-Kits
P.O. Box 209
Mt. Kisco, NY 10549
Single-board, 6802

Signetics Corp.
811 East Arques Ave
Sunnyvale, CA 94086
Instructor 50, 2650

California Computer Systems
250 Caribbean Dr.
Sunnyvale, CA 94086
S-100

CompuPro Division
Godbout Electronics
Box 2355
Oakland Airport, CA 94614
S-100

Wameco, Inc.
P.O. Box 877
El Granada, CA 94018
S-100

Priority One Electronics
9161 Deering Ave
Chatsworth, CA 91311
S-100

Jade Computer Products
4901 W. Rosecrans
Hawthorne, CA 90250
S-100

Ackerman Digital Systems, Inc.
110 North York Road
Elmhurst, Ill 60126
S-100

North Star Computers, Inc.
14440 Catalina St.
San Leandro, CA 94577
S-100

Gimix, Inc.
1337 West 37 Place
Chicago, Ill 60609
SS-50, 6809

Southwest Technical Products Corp.
219 W. Rhapsody
San Antonio, TX 78216
SS-50, 6809

F & D Associates
1210 Todd Road
New Plymouth, OH 45654
SS-50, Boards

Thomas Instrumentation
168 Eighth St
Avalon, NJ 08202
SS-50, Boards

Hickok Teaching Systems, Inc.
2 Wheeling Avenue
Woburn, MA 01888
Complete Training System
6800, Z-80

Synertek Systems Corporation
150-160 S. Wolfe Road
Sunnyvale, CA 94086
SYM-1, 6502, 6809

Ithaca InterSystems Inc.
1650 Hanshaw Road
P.O. Box 91
Ithaca, NY 14850

Quasar Data Products, Inc.
10330 Brecksville Rd.
Brecksville, OH 44141

NEEDS AND USES OF MICROCOMPUTERS IN MARKETING

Submitted by: Debbi Popo

Students in Marketing and Distributive Education perform a wide variety of tasks which have been categorized into 11 instructional units. These units include:

1. Advertising
2. Communications
3. Display
4. Economics and Marketing
5. Human Relations
6. Management
7. Mathematics
8. Merchandising
9. Operations
10. Product and Service Technology
11. Selling

These instructional areas comprise the Marketing and Distributive Education curriculum.

Computerized Classroom Management System

Teachers have had access to a computerized system of identifying individual class competencies needed for individual career objectives for several years through the Interstate Distributive Education Curriculum Consortium (IDECC). This system, known as the Classroom Management System (CMS), generates a printout for the teacher which includes a listing of all competencies needed by each student and by subtopics of the curriculum areas. The competencies were generated by research efforts obtained from business and industry needs and have been determined to be the skills, knowledges and/or attitudes needed for employment in marketing and distribution occupations.

Many competencies will be common to an entire class, such as specific human relations skills and knowledges. The CMS will indicate that such competencies are common to the entire class. In effect, the CMS provides a course outline for every individual.

It is evident, then, that computers have been integrated into many Marketing and Distributive Education programs for several years without teachers or students performing any actual microcomputer functions. We are now seeing a need for teachers and students to become involved in microcomputer operations and tasks or to become aware of computerized generated information.

Effective Uses of Microcomputers

Marketing and Distributive Education students primarily deal face-to-face with people. With the almost complete penetration of computer systems in the marketing and distribution industries, productivity is mushrooming. Students will need to learn to teach, use more reasoned thought processes, and use more human judgment and creativity. Better product knowledge of automated products and services and product use will be a key factor in all occupations that involve selling and distribution of goods and services.

Marketing occupations, overall, will need fewer workers to produce goods and services but more to market the goods. Microcomputers, however, have demanded a need for retraining of employees in marketing occupations and the need for a computer literacy course in the public schools, which currently appears to be spreading faster each month.

Change in Teacher/Student Roles in Learning?

Computer literacy, however, should not necessarily be instructed by the Marketing and Distributive Education teacher-coordinator. Ideally, these awareness and literate skills and knowledges of the computer and its uses would be taught as a separate course. The role of the teacher-coordinator would be to teach the skills, knowledge and attitudes needed to prepare for specific job choices as stated by the student's career objective. To do so, teacher-coordinators must stay abreast of current changes and technological advances which are occurring in the various marketing occupations. For example, five years ago, the curriculum may have included a unit on Inventory Control in which the students were shown how to calculate and record inventory counts. Today, students need to understand the interpretation procedures of an Inventory Control printout sheet generated by computers. Without including these new advancements in the curriculum, the needs of business and industry are not being taught; thus, the goal and purpose of vocational educators to make student productive and employable employees is not being met.

According to a recent research effort by Goldman Sachs and Company, more income is currently being generated in services than in other industries of national income. Furthermore, approximately half of all wage earners in America are working with information and services rather than in the manufacturing of goods. Keeping this in mind, it appears evident that Marketing and Distributive Education educators must display a strong emphasis on product and service technology of products and services available for consumer use. To emphasize this point more clearly, let us begin by identifying some of the truly unqiue trends occurring in the marketplace.

Apparel and Accessories

Predictions are such that the 21st century shopper will step into a mirrored fitting room and have the apparel appear on the consumer's body through computer-generated holographic projection. The projections would be tailored to the individual's physique by automatically marking the alterations while the customer completes other shopping activities. The projections would also accompany and interchange accessory choices to complete the fashion look.

At the present time, Dayton's Department Store is in process of an innovative "Media Cube" in which rear projected color slides of models dresses in the store's apparel show how different fashion looks can be achieved in an attempt to answer consumers' visual questions and to help consumers overcome insecurities about new fashion trends they might otherwise not be able to see.

Since 1978, Dayton's has also used a touchscreen computer which suggests gift items for the consumer. In 1981, this concept evolved into a bridal registry, and in 1982 a baby registry was instituted.

Hotel/Motel

Today, several hotels around the world are already adding "new techniques" to better serve their guests. Note how each involves the use of computers in one sense or another.

Hotel Des Indes, Neitherlands - photoelectric cells that automatically turn on faucets when you put your hands into the wash basin

Hyatt Regency, Georiga - each room as a special light unit that flashes to alert guests that a ship is passing on the river

Appolo Hotel, Neitherlands - elevator lists weather conditions and forecasts for nine European countries

Hanaks, Lake Tahoe, Nevada - each room is equipped with computerized bar

Schweizerhof Hoter, Switzerland - When you pick up the telephone, the radio automatically turns off so you can hear. When you replace the receiver, the radio continues

Grand Hyatt, New York - use of the computer key system is in effect

Students with career choices in this marketing occupation must be aware of these technological advancements if they desire to become productive employees in the hotel/motel industry serving guests as efficiently as possible and with thorough service knowledge of the business.

General Merchandising-Houseware

There is a new era in small electrical appliances today. Bloomingdale's Department Store in New York currently sells a coffeemaker which can be programmed the night before to make coffee the next morning...after it has ground the coffee beans!

General Electric's Versaron CTO 300, an electronic toaster oven featuring a digital readout with a built-in timer, and microwave ovens are other types of computerized houseware items currently in the marketplace. Again, the need for product knowledge integrated into the curriculum can not be overemphasized. Therefore, sales demonstrations should remain in the curriculum and also provide students an opportunity to share their product knowledge with students in other career areas of marketing.

Others

Electronic watches, computerized stereos and cruise control switches, electronic still imaging in photography, home security systems, computerized toys, computerized furniture and sewing machines, exercycles and home blood pressure kits all necessitate a need for maintaining the instructional units of selling into the curriculum.

Integrating Microcomputers into the Curriculum?

Students must become familiar with the keyboards, information displays, and learn how to send and receive information from the microcomputer. Furthermore, competency-based curriculums with specialized computer applications, simulations, drill-and-practice and tutorial software programs must be designed to enable students to be proficient in their chosen career choices. If students are not given these specialized needs, they will be at a loss in the job markets.

Menu-driven programs could be designed to ask the student questions on the display terminal, such as multiple-choice test items, true and false statements, or simply for drill and practice of some needed skills.

Now let us take a look at how computer information can help improve learning materials.

Can Computerized Information Improve Learning Materials?

Many Marketing and Distributive Education students are employed in major department stores such as Sears, Roebuck and Company, J.C. Penney Company, and Federated Department Stores. All three of these stores are in process of testing electronic catalogs for home shopping on a television screen. An analyst at Booz, Allen and Hamilton predicts as much as 50 percent of Sears merchandise sales will be made outside its stores by 1990. If this prediction becomes truth, it evidences a need more so for students employed in such businesses to obtain knowledges and understanding of computerized reports, orders, sales analysis, and various other records and reports generated by the computer to benefit the business. By incorporating such computer printouts into the curriculum, students are more apt to be better prepared on-the-job and to identify with a trend that is here today...computer-generated reports and analyses.

For merchandise sales made within stores, computerized register terminals are as common today as automobiles...almost all have them.

Customer service and employee productivity have been maximized through computerized register terminals. By depressing specific keys on the register, such as the department number and stock number, some register terminals will automatically display the price of an item and also maintain an accurate inventory count of all merchandise sold. Theft and pilferage counts, however, cannot be kept accurate unless a physical inventory occurs. This indicates a strong need to maintain a curriculum unit on store theft and pilferage.

In addition, computerized register terminals can be programmed to check references on credit cards and checks. Sears is in process of considering the possibility of allowing customers to automatically transfer money from either their checking or savings accounts to the store through ATM's (Anytime Bank Machines) at the time the goods or services are purchased.

Another system being widely used in marketing occupations is the optical wand system of entering data. The wand is a small, hand-held reader that, when passed over the price ticket, calculates and enters all the necessary information to complete a sales transaction. Many supermarket and drug chains are also utilizing a similar system for register checkout known as the Optical Character Recognition System which mechanically reads Universal Product Codes (UPC) from the product without a cashier ever touching a terminal button.

Software Programs Found to be Useful

With such a vast array of Marketing and Distributive occupations, software packages available for all student career objective areas are, needless to say, few and far between. Another point of concern is the fact that teacher-coordinators will have different types and models of computers in which to work with students. Therefore, each computer may possess a different type of program language, and available software packages may not have been designed for the specific computer a teacher-coordinator has available for use. However, some commerical software programs can be utilized to teach basic marketing principles.

One unique software program by Apple is a simulation of starting a business called, "The Lemonade Stand". Gregg/McGraw-Hill has also recently developed two software programs excellent for use in a Marketing and Distributive Education curriculum. Both programs are teacher-controlled and are accompanied by Instructor's Manuals.

The first software program is "Profit and Loss". It is adaptable to an Apple II Plus or a Radio Shack TRS-80 Model III microcomputer. With this program, students are able to see the business process in practice in five 50-minute sessions. Through simulation, students make decisions on the computer that make a business grow and at the same time, get a working understanding of the important relationships among supply, demand, pricing and advertising.

Gregg/McGraw-Hill indicates the following computer requirements before purchasing this software program:

16 KRAM
1 disk drive
printer
monitor
DOS 3.3
TRSDOS 1.3

The second software program available from Gregg/McGraw-Hill is "Enterprise Sandwich Shops: A Market Simulation". With this program, students experience how a business operates from the inside as they become involved in running a sandwich shop company. It is an excellent method to help Marketing and Distributive Education students learn basic business and economic concepts. It is adaptable to an Apple II or Apple II Plus microcomputer, and is to be adaptable to a TRS-80 by the Fall of 1983. The computer requirements set by Gregg/McGraw-Hill for this software program include a 32K RAM, 1 disk drive, an 80-column printer, a monitor, DOS 3.3 and TRSDOS 1.3.

Other commercial software programs available for Marketing and Distributive Education teachers and students include many standardized programs available for purchase from local computer stores. These programs are very general in nature, and can be broken down into three main groups of software. Some of the tasks performed by the use of the programs are listed.

General Programs:	schedule employees' work hours, analyze operations of the business, perform time-and-cost studies, keep business income and expense records and print invoices
Account Programs:	help to manage payroll, record inventory, organize business accounts, print checks, compute payroll deductions and calculate earnings and losses
Mailing-List Programs:	allow mail to be sorted by state, city and zip code; print mailing labels and personalized letters

A new software program available for the Restaurant Marketing and Management industry is the Applied Software's Restaurant Management Control Package, which keeps payroll, monitors inventory, runs food-cost analyses and is able to record sales via a computerized register terminal.

The unavailability of software programs for most curriculum areas in Marketing and Distributive Education is primarily due to the fact that educators in the field, as in most other vocational areas, have not been heavily involved in the development of such packages. Who knows better what the needs of Marketing and Distributive Education students are than the teacher-coordinators themselves, who also work in conjunction with those students' employers?

Although a few excellent software programs have been identified for Marketing and Distributive Education, developing, using and integrating software packages for use in the Marketing and Distributive Education curriculum cannot meet the needs of our students until educators involve themselves in the development of such software. Otherwise, if specialized functions for which only limited or no commercial software exists, educators will need to learn programming skills (the list of instructions that enable computers to execute tasks) themselves.

The "information explosion" due to computer technology, makes it imperative that today's Marketing and Distributive Education student gain an understanding and appreciation of computerization and how it has affected business and industry, how it is being used today, and its projected needs, uses and capabilities for tomorrow.

Conclusion

In conclusion, Marketing and Distributive Education students must be able to utilize modern computer resources. They are essential tools to assist in the management of information in marketing occupations. Minimal operational skills will become an absolute necessity if students are to lead productive and useful lives.

EMERGING CAREERS: THE CONSEQUENCES OF HIGH TECHNOLOGY

By Judith M. Rodenstein, Ph.D.

According to futurists, there is a new revolution upon us which will affect the way people earn money, spend their leisure time, and relate to one another. These dramatic changes will be the direct outcome of high technology. Some occupational forecasters believe that high technology applications at the work site will be the catalyst for the permanent elimination of up to 45 million jobs once computerized, labor-saving devices become operant. According to Occupational Forecasting, Inc., a consulting firm in Arlington, Virginia, "Robots, automation, communication and computers are changing the entire occupational infrastructure of U.S. industries."

In newspapers, magazines, and television advertisements, we can feel the excitement and challenge to create--which is part of the "high technology revolution." We will all be able to complete tasks, engage in stimulating activities and process information in a way which we were never able before. Yet, at the same time we hear of the tragedies of workers who have spent 20, 30 or 40 years in an industry and have lost their jobs permanently because technology can now do their jobs more effectively. How can this conflict be resolved?

The innovative changes in the structure of work and the work force, on one hand, are eliminating jobs and, on the other hand, result in what are called "emerging occupations." The definition of that term is:

> Emerging Occupation - Those for which new employment opportunities are well evidenced in the changing patterns of business, commerce, industry, science, technology and arts. Such occupations generally do not have a well-defined occupational title, qualification, or employment classification and wage standards. They appear rather amorphous, but sufficient employment is occurring to identify this occupational area. The numbers of workers employed in these emerging occupational areas are likely to be growing at a rate substantially above the average of all occupations; new educational and training programs are being established and demand exceeds supply; shortages are clearly evident. (Occupational Forecasting, 1983)

Employers and employees then need to consider the following questions:

- -Which jobs will be discarded in my industry?
- -Which new occupations will be created in my industry?
- -How will these sweeping changes affect the jobs of both blue collar and white collar workers? (e.g., What new skills need to be mastered?)
- -What are the challenges and opportunities for the nation's primary trainers of labor, the educational and training systems?

This chapter will answer some of these questions by examining several emerging or changing occupational clusters which are a direct result of high technology applications: robotics, communications, medicine and manufacturing. The occupational categories chosen for discussion are by no means inclusive but serve to represent the range of careers which will emerge and/or change as they interface with computers.

Robotics

It is common knowledge that robots are finding their way into the workplace. In fact, when the data related to sales and production are examined, the scope and impact of robotization is staggering. Robot sales in this country are growing at an annual rate of 35 percent. Optimistic forecasters are predicting general sales of robotized manufacturing equipment in the United States to reach $2-4 billion by 1990. The following forecasts have also been made:

- -By 1985, 20 percent of the labor force in the final assembly of autos will be replaced by automation. (One automobile manufacturer alone has announced plans for 14,000 robots by 1990.)
- -By 1987, 15 percent of all assembly systems will use robot technology.
- -By 1988, 50 percent of the labor in small component assembly will be replaced by automation.
- -By 1990, the development of sensory techniques will enable robots to approximate human capability in assembly.

(National Center for Research in Vocational Education, 1982)

Currently, robots help weld, cast, form, assemble, paint, transfer, inspect, and load and unload parts into and out of a number of different machines. Reprogrammable robots can be used for diverse production operations or single function operations. No longer are robot microprocessors attached only to mainframe computers but they are becoming flexible units, flexible enough to be part of a major restructuring of manufacturing operations which mix human and robot jobs.

Despite all the publicity attending this new development, the issue of what a robot is, generally is not well defined. Although one tends to think of a mechanical person as a "robot," a better term for what is commonly being placed in industries today is a "robot-arm." It is essentially a mechanical arm that is bolted to a base and fitted with a special set of fingers or tools and then programmed to go through a series of repetitive motions to perform a particular task. Most models do not possess the ability to move around a factory from one location to another, nor do they generally have the ability to sense the task performed. The Robot Institute of America defines an industrial robot as,

> "a reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions to accomplish a variety of tasks."

The terms "reprogrammable," "multifunctional," "variable programmed," and "variety of tasks" are the key words which differentiate robots from other forms of special-purpose or fixed automation. These key words refer to the ability of the robot to be adapted to many different kinds of jobs in many different industries. In contrast, fixed or special purpose automation is less universal and includes machines designed to do one particular job in one specific industry.

In order to understand what careers will emerge from robotics, it is necessary to understand how the "robot technology" is being applied. Currently, the metal working industries most aggressively utilize applications of the robot industry. Machine tending has been one of the largest areas of robot application.

One of the earliest and most successful applications was unloading diecasting machines. Robots have also been used in the diecasting industry to load inserts into the dies, lubricate dies, feed castings to quench and trim operations and even to ladle metal and deposit scrap into remelt systems. Unloading injection molding machines is a similar application that has also employed robots successfully for many years.

Foundries have implemented a relatively small number of robots, but have used them in a wide variety of applications. Robots are used to transfer hot castings from continuous pour lines to shakeout equipment, and to remove cores from core making machines. Applications in mold construction include installing and removing mold clamps, setting cores, venting molds, and flame drying molds.

A very large area of application is resistance welding applications, principally done in the automobile industry. Typically, a large number of robots are used within each system. In these applications, the robots handle weld guns and tend indexing on continuously moving lines. When welding smaller parts, it is possible to have the weld gun in a fixed position and the robot is used to move the part through a stationary weld head.

Spray painting is the most common application of continuous path robots. Material handling application of robots are common in all segments of industry. Robots are used to stack and destack, load and unload conveyor lines and to palletize.

Naturally, as the number of uses for robots increases, the potential need for people in new jobs related to robots also increases. There are three types of employers where those with training in robotics will be in considerable demand. The first is robot users, second--robot manufacturers, and the third is in the field of education where many institutions are currently expanding their programs to include instruction and job upgrading in robot-related subjects.

According to William Weisel, Prab Robots, Inc. (1983), the following categories of job assignments are forecasted in the field of robotics:

- Research/Development
- Design
- Manufacturing
- Application
- Marketing
- Service/Maintenance
- Training/Teaching

Each job category will now be further defined as it relates to industrial robots.

Research/Development. These activities may take place at robot manufacturers with robot users, educational institutions and/or consulting firms devoted to robotics. Subject matter is primarily in the area of applied engineering or computer sciences.

Design. Design includes the design of the basic robot, the controls and related equipment. Educational background to do this work would include approximately a BS level of mechanical engineering. Control design could be done by a robot manufacturer or by a manufacturer of controls. Educational background needed would, at the least, be a BS in electrical/electronic control engineering. Application or modification of controls could be done by a technician with an associate degree. Design of the related equipment required to integrate a robot into an already existing manufacturing system could be the responsibility of the robot manufacturer, the user, consulting firms, and/or equipment suppliers.

Manufacturing. Two different points of view need to be considered when assessing the future jobs in the field of manufacturing robots. One set of skills are needed during the process of manufacturing the robot and related equipment. Another set of skills is involved in the utilization of the robot within the manufacturing system.

Producing robots requires knowledge and skills similar to those required for production of machine tools, material handling equipment and other types of capital goods. A wide range of educational background can be appropriately adapted for entry into these kinds of jobs. For example, a simple lathe, which produces standardized parts, can be operated by an individual who was merely trained on the job. More complex processes could only be successfully completed by a worker with an associate degree in the particular tool technology.

When the robot is assembled, it will go through a test period where all segments and parts will be tested to see that they withstand stress and operate properly under the appropriate environmental conditions. Individuals involved in quality assurance will need to attain at least an engineering technology associate degree to understand the testing information and instrumentation.

Application. New career opportunities will also be available for individuals who will implement an overall system. The educational equivalent of a BS/MS in industrial or manufacturing engineering is necessary for these new occupations. As the complexity of the system increases, so does the need for greater education. For example, a machine which needs to repeat the same welding operation over and over again on every car on an assembly line would require a different level of knowledge than a robot which needs to be programmed to selectively perform an operation on certain products.

Being able to justify the purchase of a robot involves another set of skills--the ability to analyze the basic cost factors in setting up, selecting, and using a robotic system in a way that results in efficient and quality production. A background in industrial engineering is necessary for the type of analysis done here. In addition, controls and programming are major areas of attention. Again, the complexity differs based on the application and method used to integrate robotics into the manufacturing process.

Marketing. Most manufacturers have their own sales representatives and distributors. Personnel engaged in sales of systems should have the following skill: in-depth understanding of robots. The individual should spend time in all areas of the manufacturing plant: the shop, design department, field service activities. An associate degree in engineering technology is the minimal degree which should be obtained by a person in this position. Also necessary are skills in human relations. Thus, a person with strong technical skills and communication skills will be able to explore a career which would involve approaching prospective manufacturers who could use robots in a wide range of application.

Service/Maintenance. Because it is necessary for the robot to function property once it is in operation, new jobs need to be created for the servicing of industrial robots, ensuring that the operational problems connected with the robot are solved, along with minor adjustment and modifications which are needed to flexibly fit the robot into any assembly line. In addition to the service work, there is also a need for workers who are capable of installing entire robotic systems in a factory.

Training/Teaching. Robot manufacturers provide training for user personnel and their employees. They are responsible for two types of training about their robots. The instructions can be aimed at an overall understanding of the operations or on only one of the functions. An educational background is especially important at this stage, along with a technical background because materials must be presented in a way that will be understood by a layperson. Teaching robotics also takes place in educational institutions. Courses may range from an introductory course in a technical high school to a doctoral level course at a university.

In summary, the number of robot installations is steadily increasing. This growth offers new job opportunities. As a result of robotics, a variety of jobs will also be created in education, business and industry. A general technical education is a necessary first step in these careers. However, individuals who want to succeed in robotics will also need to complete specialized training either on the job, at robot manufacturers, educational institutions, or those companies which provide goods and services associated with robots.

Communications

We've all heard of cable television and telemarketing--but what are laser technicians? teletext operators? electronic switching systems? They all represent what has and is happening in the communications industry as a result of high technology applications. "Telecommunications" is the word used to describe the impact of microprocessors on the field of communications. Because of the variety of applications, the best way to define telecommunications is to give examples of it. Telecommunications are data networks, satellite and digitally-encoded telephone and telecopy devices and systems, optical fibers and cables, electronic mail and shopping services, text editing and distribution systems, and electronic funds-transfer systems.

It has been forecast, that in the future 14 million billion intercommunication connections will exist--a universal interconnect system between industry, home and the office which will serve a vast array of information processing devices, equipments and systems transmitting any information in any format (including stored voice, patterns, video images) to anywhere in the world. To achieve this, optical fiber cabling will replace copper cabling and, thus provide superior transmission, loading capabilities, and fidelity. All types of communications will be affected by telecommunications, e.g., information, entertainment, and data manipulation are becoming available to government, business, and private systems. Electronic office and automation will affect more than 75% of the approximately 50 million white collar jobs. An information system such as Videotex will revolutionize financial transactions, retailing, advertising, and related information services. In fact, it is forecast that by 1990, 20% of all U.S. retailing will be over videotex systems. Forty-five million homes will then be equipped with equipment which will need to be serviced. Paperless offices will lead to paperless homes through the development of such systems as Teletext--the electronic newspaper in operation in England and experimentally in the United States. Uses of telecommunications are expanding at such a rapid rate that futurists are calling the information world of the 1990's, "The Global Village."

What does all this mean to the world of work? Who are the companies (future employers) that are emerging as leaders in the telecommunications industry? They currently include:

- telephone companies and services
- cable television networks, stations and businesses
- national and local weather forecasting services
- United State defense systems
- Automatic Teller Machine networks used by banks
- computer-assessed networks
- stock market brokers, bankers and other financial managers
- radio, television and news networks and "superstations"

(National Center, p.6)

To be more specific, AT & T has installed the first part of a laser-powered fiber optics system on the East Coast. Voice and data transmissions are sent over glass strands. Light pulses, rather than electrical signals, will be the workhorses of the information age according to R.W. Kleenert, President of AT & T's long lines department. It is part of the company's expanding system of advanced communications systems, including digital microwave, satellite, cable routes as well as laser systems. Digital communication across continents is all a part of AT & T's future.

These service-oriented systems will rely, in turn, on the services of manufacturers of telecommunications equipment. The equipment will no longer consist of parts that need to be assembled but instead will be dependent on computer-operated design and production. In fact, the number of workers needed to assemble the equipment has already dropped dramatically. For example, Telecommunications Ericson in Sweden reduced its work force from 15,000 to 10,000 workers between 1975 and 1978 (Norman 1981a). This trend has been happening all over the world.

Installation and maintenance labor will be similarly affected. An example that is obvious to everyone that owns a telephone is the advent of the do-it-yourself phone installation. A technician used to schedule an appointment to come to a house and install the telephone system. That is no longer the case. Jacks are placed in houses and residents can buy their own telephones and install them with a small clip. The labor demand for line and cable workers is also declining for similar reasons. Permanently installed lines, buried cables and quick-connect terminals are regularly used in all communication systems.

New switching equipment will also affect the jobs of telephone operators. Mechanical voices and verbal discrimination capacities which are built into computers will soon depress the need for telephone operators even more.

Several new occupations are appearing as the more traditional occupations are being phased out. Laser technician is a new and growing occupation. Lasers are currently being used to communicate images, words and pictures that are transmitted across the country for newspaper copy. According to Orth and Russell (1980), it is reasonable to assume that the use of lasers will expand in the future. They are capable of communicating a vast amount of information and the fiber optics used are resistant to electromagnetic deterioration. To become proficient in this field, technicians would need to enroll in a Laser/Optics Program and study how the laser optics system works, why they work, and how to direct and control the laser beam.

In the telephone industry, most technican jobs are with switching systems or with signal transmission. The new electronic switching system (EES) is programmed to fit each office. Thus, installation and maintenance is different than with the older systems. EES is programmed to monitor its own performance and diagnose circuitry problems. There are no moving parts which need to be repaired but knowledge of electronic computer-based systems is required (Dymmel, 1979).

Likewise, in the transmissions systems, such as cable networking, job skills are changing. Again, the optical systems involved will be reengineered and all equipment will remain principally electronic in its operation. So, although there will still be a need for workers to bury cables and install quick-connect terminals, the entire job picture might change dramatically again in the near future with the new space shuttle system which will put many communications satellites into orbit, thus increasing direct beam transmission by satellite and reducing the number of cable television technicians needed.

New jobs are not expected in great numbers with the applications of high technology to communications systems, aside from the laser technician and the need for more programmers and computer specialists. Instead, the production and monitoring skills needed by workers will change with the presence of computerized monitoring systems and electronic operations.

To summarize these changes, a job announcement in the area of telecommunications might now read as follows:

> Because of our commitment to innovation, the Switching Systems Division of ______ is involved in the design and development of a distributed microprocessor controlled digital tandem telecommunication switching system. This specialized common switch (SCX) has a 3000 port capacity. You will be responsible for maintaining customer system in operational status, performing routine preventative maintenance, and installing and testing new software releases at our customer site in Everycity U.S.A.

Medicine

Medicine and electronic engineering have joined together and applied high technology to the art of healing. Technical innovations have led to more sophisticated specializations throughout the entire medical services hierarchy. The increased number of specialists has resulted in a larger bureaucratic organization and the consequent emergence of new occupations. This is apparent in clinical services but has an especially strong impact on the career structure in ancillary departments.

What has happened in the health fields? Microchips, portable batteries, electronic rivision, senses developed in robots, microsurgery, and genetic engineering are exciting applications of high technology which have taken place just during the last few years. Research in robot intelligence to benefit the disabled and handicapped continues. Programmers, technicians and educators are working with computer-based machines which will aid the disabled and elderly in keeping their lives independent.

Two trends will occur in the health care industry which parallel what has been seen in many other occupational areas when high technology applications become prolific in an industry. A number of new occupations will be created, but more importantly, old jobs will need to incorporate new skills so that the new "high tech" job tools can be mastered. Professionals will be needed to design, purchase, and maintain the machinery. This necessitates the need for bioengineers, electronics technicians, materials management staff, and data entry personnel. For example, a worker in the National Tumor Registrars Association will now be able to establish and maintain a register to follow patients with a diagnosis of a tumor, maintain treatment records, retrieve and analyze that data and disseminate it to other professionals (Orth and Russell, 1980)--an ineffective and tedious task before computers were introduced.

In addition to the skill upgrading of already existing occupations, there are several new fields in medicine. One such field is that of medical electronics technican. The technicians need to master not only the skills required by artisans or radio/television repairers, but also must have an understanding in human physiology. Training would involve a program which blended knowledge and skills in mini- and microcomputers, electronic devices, electronics, medical instrumentation, human physiology, medical instrument safety and grounding techniques, semi-conductor circuitry, and principles and design of medical electronic equipment. Students need to be able to repair, calibrate and use the medical devices. Most of the jobs currently are in hospitals. Job titles connected with this type of occupation are medical electronics technician, biomedical engineering technician, and biomedical research assistant. They are also employed by medical instruments manufacturers to help install and maintain equipment once it is sold to a hospital. Those individuals with a background in education might also train staff how to use the equipment. The bionic man and woman were once thought of as characters only on an adventure show. With the proliferation of microsurgery and mechanical/engineering dimensions into medicine, the fantasy has become reality for many people.

Advanced Computer Applications - Careers Related to CAD/CAM

Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) is becoming critical to design and production in successful manufacturing facilities. CAD refers to the designing, drafting and analyzing of machine parts through computer graphics displays on a screen. It not only speeds up the laborious work of drafting but also enables the designer to study various aspects of an object by rotating it on the computer screen, separating it into segments, or enlarging/shrinking the details. CAD programs also allow the designer to: do on-screen stress tests and then modify the design based on the results of that test, and determine numerable calculations on the design before it even leaves the designer's screen. This means that something like the Fisher body of a car can be designed on a screen. While on the screen, it would be possible to determine how strong the body will be, what it will weigh, how it will perform and the parts that need to be modified for a successful performance. (In fact, the parts can actually be fixed right there on the screen before the car is even built.)

CAM, on the other hand, is not quite as innovative, that is, until it is combined with CAD in an industrial setting. CAM alone is merely the computer control of production machines. This ranges from machine tools running on punched tape instructions to programmed robots. CAM results in increased speed and accuracy in a manufacturing facility. CAD/CAM together can shorten the time between design and production. The product can be designed on the screen and, once modified and refined (CAD), dissected into production stages and production schedules by CAM programs.

This trend in using CAD/CAM in industry is growing. According to the January 1982 issue of Electronic Design's technology forecast, 7,500 CAD work stations had been installed by 1980. The number is forecast to grow to 75,000 by the end of 1985. CAD/CAM thus represents a career cluster of new occupations and new training potentials in business and industry.

The workers trained to fit into these occupations can be new workers trained specifically to work at a CAD/CAM station or can be upgraded employed technicians who need advanced CAD/CAM skills that can be learned at a technical college or a college engineering program. Most of the CAD/CAM careers will involve use of the computer in one or many aspects of design and production.

The first apparent changes in already existing careers will be in the drafting and design functions--replacement of drawing boards with computer graphics design stations. The designer would be required to use and operate the new tools present in the computerized design station, in addition to the new vocabulary of "computerized drawing." Very little knowledge about computer science would be needed. Instead, the designer would be trained in an engineering discipline such as mechanical, electrical, civil, or in commercial art. In addition, new career skills related to helping engineers become more effective managers of the advanced technology workers and equipment would need to be developed. The automation of industry will thus begin when all design information is placed in computer memory. This would then represent a current, available data base which would be accessible to all departments. Information could then be used for designing parts, developing an assembly schedule as well as for material planning, accounting and other business management applications.

Further down the line from the design functions will come the application to the actual manufacturing processes. The technologies, as applied to the production processes, will affect employment levels, occupations and skill content. For example, in the textile industry, new technology is expected to replace 300,000 textile workers by 1990. Patterns can be cut by computer-controlled machines. Sewing machines are also able to be computer-controlled. The same trend is likely to be seen in most industries which can effectively change over to computer-controlled production machines.

The careers in industrial maintenance represent one of the few occupational areas which are expected to grow as a result of the technology. The growing complexity of the CAD/CAM equipment will result in a greater need for workers with skills in the area of industrial technology.

There is little evidence that entirely new jobs will need to be created to keep up with the advent of CAD/CAM, but instead, workers will need to be upgraded by learning how to work with new "job tools," incorporating both new knowledge and skills into their current job content. The typical job description will look like the following:

> DRAFTSMEN: We are currently looking for mechanical draftsman for a CAD/CAM system. Experience in CALMA Graphics or Gerber Systems required.

Some occupations in design and manufacturing will probably not survive the new technology. Those that do will require, at least, an elementary knowledge of computerized control systems.

Conclusions

In summary, from this brief overview of several occupational clusters, it is clear that the challenge of change confronts the world of work. While an array of occupational titles have developed from high technology applications (such as Industrial Laser Process Technician, Industrial Robot Production Technician, CAD Terminal Product Engineer, and Bionic Electronic Technician), nevertheless the skills needed for many of these careers are those which can be learned by today's workers through an upgrading-training program. For example, even though using CAD is a new technique for draftsmen, it is not necessary to eliminate all draftsmen from the work force and take a new crop of graduates and teach them CAD. Instead, most of these emerging careers can be available to workers who enroll in a retraining program which will teach them how to use the more effective tools, the computer controlled innovations. True, jobs such as those in the textile industry will be eliminated and several careers will emerge which require an entirely different training program, but that will not be the case with the majority of emerging careers.

Therefore, it is critical that each worker who is part of an industry that will soon become computer-controlled examine the options open: Can retraining occur within the industry or will positions be permanently eliminated? If retraining can occur, the most expedient way to get that training should be determined and pursued. We will all be affected by the computer in our job one way or the other. Determining the affect on each worker's participation in the work force is critical.

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